THREE ESSAYS ON CONFLICT, INSECURITY, AND LIVELIHOODS

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THREE ESSAYS ON CONFLICT, INSECURITY, AND LIVELIHOODS

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Despite Economics increasing interest in the effects of conflict, our empirical knowledge has lagged behind. Recent studies have highlighted important and varied long run costs to conflict. Due to a lack of research on how households adapt to conflict and insecurity, however, we have little understanding of how these costs emerge and little evidence with which to design policies. This dissertation contributes by examining the responses of households to insecurity, particularly during conflicts.

While other authors point to the importance of insecurity, insecurity has never been measured. The dissertation introduces a methodology to create spatially disaggregated measures of conflict risk and uses these to present the first estimates of the relative contributions of insecurity and exposure to violence to the aggregate household costs of conflict. While the dissertation leverages several unique datasets, I show that more widely available data can be used to similar effect. Having established that insecurity accounts for at least half of the costs in rural Northern Uganda, I examine household livelihood responses along both intensive and extensive margins. Lastly, using a ten period panel with the first direct household subjective perceptions of insecurity, I investigate the impact of these perceptions on income and find that these effects differ throughout the year, likely reflecting the heterogeneity of income generating opportunities throughout the year. Moreover, I study the effect of prior perceptions

in determining current beliefs and find that prior beliefs have little economic significance. Rather, agro-meteorological conditions, particularly pasture quality (NDVI), drive changes in subjective perceptions of insecurity.

The primary contribution of the dissertation is to underline the importance of responses to insecurity in determining the costs to conflict. Despite the focus on exposure to violence, the majority of the aggregate costs of conflict arises from responses to insecurity and may occur irrespective of the presence of violence. More broadly, by focusing on areas and households which experience conflict, current studies conflate the effects of the risk and realization of violence. The results here suggest that the large and varied lasting costs of conflict likely can be traced back to household responses to insecurity.

BIOGRAPHICAL SKETCH

Marc Rockmore was born on July 29, 1978 in Southern France and primarily grew up in Pittsburgh. Marc earned a BA in Economics with honors at Swarthmore College in 2001. After college, he moved to Washington, DC to work on issues related to domestic health insurance at the Urban Institute. After earning an MA in International and Development Economics from Yale University, he returned to Washington, DC to do research on international development at the International Food Policy Research Institute. In 2007, he entered the Ph.D program in Applied Economics and Management at Cornell University.

To my wife, Anuja

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CHAPTER 1

THE COSTS OF CONFLICT: MEASUREMENT AND PATHWAYS

The empirical literature on the costs of conflict has evolved from initial cross country aggregate measures of foregone economic growth to the more recent examination of the non-monetary micro-costs, such as education and health, associated with conflict. Currently, the literature is further evolving towards a third stage which aims to understand the pathways from conflict to the observed costs. While the former two stages have quantified large and varied costs from conflict, the emerging third stage is essential for designing policy, both with respect to targeting and mechanisms. This dissertation aims to contribute to this third stage by quantifying the effects of insecurity (i.e., the risk of violence during conflict) separate from its manifestation (i.e., attacks and exposure to violence).

Whereas existing studies have not empirically modeled and measured insecurity distinctly, I both propose a methodology for creating spatially disaggregated measures of conflict-risk as well as provide the first empirical study with actual household subjective expectations of insecurity. Additionally, I use perhaps the largest household data set ever used to study conflict to provide a comprehensive view of household responses to insecurity. Lastly, while time has been used to identify the effects of conflict, this has typically relied comparisons across years. Using unique quarterly data, the dissertation examines the effects of the seasonal timing of perceptions of insecurity by estimating quarter-specific impacts of subjective expectations.

The early macro-based research examined used cross country panel data to examine the effects of the incidence of conflict on GDP (per capita) finding estimated impacts ranging from 1.25 to 2.2 percent lower GDP per capita per year of civil conflict (Collier 1999; Imai and Weinstein 2000; Hoeffler and Reynal-Querol 2003). Taking into account all the factors associated with conflict, including spatial spillovers (Murdoch and Sandler 2002; 2005), Collier and Hoeffler (2007) estimate that the cost of a "typical" civil war is roughly 250 percent of the initial GDP. These estimates, however, only focus on the aggregate economic effects, as measured by GDP. In addition to the difficulties in accurately measuring national account in the midst of conflict, GDP is only one portion of the costs of conflict. Conflict may have long run impacts through educational or health outcomes. Additionally, these estimates do not explain how these costs are distributed both within the country as well as across the population.

While a related literature on peace dividends using asset prices has emerged (for housing prices: Besley and Mueller 2012; Collins and Margo 2007; for stock prices: Abadie and Gardeazabal 2003; Guidolin and La Ferrara 2007; Zussman and Zussman 2008; Zussman, Zussman, and Nielsen 2008) has emerged, the current empirical literature primarily focuses on individual and household outcomes. This micro-conflict literature finds substantial conflict-induced costs along a number of different dimensions including education (Akresh and de Walque 2011; Blattman and Annan 2010; Shemyakina 2011), nutrition/health (Akresh *et al.* 2011, forthcoming; Minoiu and Shemyakina forthcoming) and shifts in behavioral parameters such as risk aversion or time preferences (Voors *et al.* 2012; Callen *et al.* 2012; Cassar *et al.* 2012). With the possible exception of the literature on the behavioral consequences of conflict, the causes for the observed lower outcomes are unclear. In particular, it is not clear whether these outcomes arise predominately from direct exposure to violence or rather from the effects of risk, presumably via

deliberate household risk mitigation. This distinction has important consequences for the design of policy interventions.

While insecurity has been believed to have an important effect in spreading the costs of conflict (Dercon 2008; Justino 2009), this has only been recently supported empirically. Recent research have found household behavior that is consistent with *ex ante* risk mitigation strategies in labor markets (Fernández *et al.* 2011; Menon and Rodgers 2011) and the choice of crops and livestock (Finnström 2003; Bundervoet 2007; Vlassenroot 2008). While these behaviors are often interpreted as responses to insecurity, the actual risk or perceptions of risk have not yet been measured; rather, the research has relied on qualitative priors on insecurity and potential responses. Consequently, the responses could also reflect a variety of other unmeasured factors. Moreover, since these studies focus on specific responses, such as in the labor market, we lack both an understanding of the overall effects of insecurity as well as the importance of the relative pathways.

This dissertation makes several contributions to understanding how insecurity contributes to the observed costs during conflict. In economics, data on subjective expectations are rarely collected (Manksi 2004), especially for expectations of violence. To help to address the absence of relevant data, the second chapter proposes a methodology for creating spatially disaggregated measures of statistical and perceived risk based on spatio-temporal community-level behavior and placement of attacks. This methodology is then used to create the first estimates of the separate effects of the risk and realization of conflict. The findings suggest that while the effects of exposure are more important than those of risk in households which are attacked, the aggregate effects of insecurity are more important. This reversal in relative importance results

from the relatively small fraction of the population who are directly exposed violence whereas insecurity is more widely experienced. More broadly, this suggests that a focus on the direct victims of conflict may overlook the majority of the costs.

While the second chapter finds substantial individual and aggregate costs from conflict, it does not examine their origins. The third chapter examines the correlation between the above measures of risk and household behavior using data from close to 700,000 households. I find that most of the consequences of insecurity in Northern Uganda are along the intensive margins. In particular, households respond to insecurity by changing the value (-65% at the mean level of insecurity) and composition of livestock holdings. Looking at the returns associated with different types of livestock, households shift from more profitable but risky larger livestock to smaller livestock. There is also evidence of men shifting from unpaid family labor to becoming employees whereas female labor force participation and allocation is unaffected. In contrast to asset portfolios, risk seems to have only limited effects on sources of income. Similarly, there is no real effect on the returns to assets. Moreover, once the asset portfolio allocation is included in the model, the economic effect of insecurity from chapter 2 disappears. This suggests that the effect of the risk of violence may operate primarily through changes in assets composition and in the activities in which these are employed and not through changing returns to these activities

While chapter 2 provides the first quantitative evidence of the costs of insecurity, it uses constructed measures of risk which may differ from actual perceptions. Using a 10 period panel of household perceptions of insecurity, Chapter 4 uses the first direct subjective expectations of insecurity to study their effect on income. I find that their significant effects on income components are masked in the aggregate income measure. Moreover, there are substantial and

varied impacts of insecurity inter-seasonally that cannot emerge in the current cross-sectional literature. Lastly, the evolution of perceptions across time is studied. I find that prior beliefs regarding insecurity have little impact on current beliefs whereas agro-meteorological conditions, particularly pasture quality, are important determinants. As is discussed in Chapter 6, this suggests that agro-meteorological conditions can be used to create models forecasting perceptions and therefore enable pre-emptive policy interventions.

Taken together, the chapters in the dissertation provide the first comprehensive examination of the relative effects of insecurity (i.e., the risk of violence) versus actual violence. In particular, contrary to general beliefs, direct exposure to violence does not appear to be the driving the majority of conflict related costs, as measured by income or consumption. Additionally, the costs from insecurity appear to arise from costly household responses as opposed to general equilibrium effects, such as prices. Chapter 6 concludes by examining the implications of the previous chapters for the policy and considers research questions which arise from the dissertation.

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CHAPTER 2

THE COST OF FEAR:

THE WELFARE EFFECTS OF THE RISK OF VIOLENCE IN NORTHERN UGANDA

I. Introduction

The 2011 World Development Report notes that one in four individuals live in fragile and conflict-affected countries, or in countries with very high levels of violence. Moreover, not a single Millennium Development Goal (MDG) has been achieved by a low income fragile or conflict-affected country (World Bank 2011). Despite this clear influence on both country and individual-level outcomes, economists have a very limited empirical understanding of the effects of conflict, especially at the household level. The existing literature primarily examines aggregate national measures of the economy or focuses on micro post-conflict outcomes; the behavior of households during conflict remains almost unstudied. In particular, since the majority of people in conflict and violence-prone countries do not experience violence directly, the near-exclusive focus of the literature on the experience of violence[1] ignores potentially significant losses due to the persistent insecurity and uncertainty.

Although both insecurity and exposure to violence surely contribute to the costs of conflict, the distinction between the two has important consequences. If the costs from conflict primarily arise from direct exposure, this implies that the costs of conflict are disproportionately borne by a narrow set of individuals and only materialize during attacks and in *ex post* household responses.

[1] Throughout the paper, the experience of violence refers to first-hand exposure to attacks. Being present at an attack without being directly attacked is not considered as "experiencing violence" in this paper.

In this case, policy interventions are necessarily reactive as they can only occur after attacks. In contrast, if the costs are primarily due to insecurity, then the costs of conflict are spread out over the broader population and are likely the result of *ex ante* risk mitigation strategies. That is, the costs from conflict are primarily "self-inflicted" by households as they seek to minimize exposure to violence and its expected impact. Consequently, policy interventions should focus on broader swathes of the populations and can be pro-active rather than waiting for the outbreak violence.

Several recent papers examining the effect of conflict on labor markets have found responses consistent with responses to insecurity (Dell 2011; Fernández *et al.* 2011; Menon and Rodgers 2011). Similarly, numerous authors have linked the increases of low-risk low-return crops during conflicts to insecurity (Finnström 2003; Bundervoet 2007; McKay and Loveridge 2005; Vlassenroot 2008). In the absence of empirical measures of insecurity, these claims cannot be directly examined nor can the potential (and relative) effects of insecurity be quantified.

This paper provides the first empirical estimates of the effects of the risk of violence during conflict by creating spatially disaggregated measures of risk. Similar to Mueller and Besley (2012), I rely on the spatio-temporal variation in the realization of violence. Whereas Mueller and Besley measure sectarian violence in Northern Uganda at the regional level, using representative community and household data from Northern Uganda, I am able to look at the variation at a much more disaggregated level and thereby to create community level measures of conflict risk. Although individual risk can differ from community risk levels, qualitative and quantitative evidence strongly suggests that exposure to violence within Northern Ugandan communities is largely homogenous and independent of household attributes, In contrast to the

existing conflict literature which conflates the effects of the risk and realization of violence, by using these measures of risk, this paper provides the first separate estimates of their respective effects.

The unique data allow for the creation of disaggregated measures of both statistical (objective) and perceived (subjective) risk. While subjective perceptions of risk are conceptually superior, these are rarely collected, particularly in conflict data (Manski 2004). In contrast, as is shown in this paper, statistical measures of risk can be created using the relatively more available data on the placement of attacks. Comparisons of the two measures of conflict show that the effects of the two are qualitatively similar thereby suggesting a methodology for creating disaggregated risk measures in other contexts.

At the individual level, there are higher costs (in terms of per capita household expenditure) from the experience of violence than from conflict risk (10 percent vs 2-8 percent). However, since considerably more individuals suffer from conflict risk than are exposed to violence, risk accounts for at least half of the aggregate household losses from conflict. Additionally, I present the first empirical evidence of within-country spillovers of conflict-related losses onto households that are not directly exposed to violence. Lastly, this research adds to the literature on food aid by providing rough estimates on the effectiveness of food aid in mitigating conflict-related economic losses among households in Northern Uganda.

The remainder of the paper is structured as follows. Section II briefly considers how conflict-related risk can affect household behavior. Section III discusses the heterogeneity in the risk of experiencing violence and reviews the relevant economics literature. Section IV briefly

highlights the history of conflict in Northern Uganda before section V presents the empirical strategy. Sections VI and VII discuss the underlying data and the estimation results, respectively. Section VIII concludes and discusses policy implications.

II. Risk, Shocks, and Conflict

The literature on choice under uncertainty provides a framework for understanding the role of risk in household decisions. This literature views households as living in uncertain environments where choices regarding asset and activity portfolios are made before the uncertainty regarding future shocks is resolved. Households make decisions at two discrete points in time. First, households make choices before knowing which, if any, shocks will occur. *Ex ante* strategies, such as diversifying crops or delaying planting, are used to manage the risk[2], that is, to reduce the probability of the shock or the magnitude of its effects. A second choice takes place after any shocks have occurred, whether positive or negative. At this time, households use *ex post* risk coping strategies (e.g., selling assets) to smooth incomes (Deaton 1992, Dercon 2002, or Townsend 1994).

In addition to the risk of death or injury, conflicts can also affect both *ex ante* and *ex post* decisions. For instance, assets that support peacetime livelihoods may become liabilities during conflicts (Lautze and Raven-Roberts 2007). Certain assets, such as livestock, are not only more likely to be looted, but they may also increase the risk of being attacked, especially if they are difficult to conceal. The composition of crops is also likely to change as crops whose harvest may be delayed at low cost, such as cassava, may be particularly advantageous in conflict zones.

[2] Risk refers to the possibility that a particular shock may occur.

In contrast, perishable crops, such as fruits or vegetables, often need to be harvested within a short period of time. If households are forced to choose between venturing to exposed fields to harvest and remaining in the relative safety of their village, they may choose to not cultivate such crops in the face of the risk of violence. More broadly, conflict-related risk should lead households to avoid otherwise profitable activities with sunk costs, or assets that cannot be easily hidden, transported or liquidated (Dercon 2008). This suggests that as perceived risk increases, income and consumption should decrease below their risk-free optimal levels. In certain cases, households might consume more in order to prevent looting although this strategy is unlikely in the poorest households, who save little.

Conflict also reduces the effectiveness of *ex post* risk coping strategies thereby increasing the importance of *ex ante* risk mitigation. Markets for asset sales[3] or for labor may no longer function well, while migration may become restricted. Similarly, both community and informal insurance networks may weaken due to the death or migration of members, or the increase in shocks experienced by network members due to the conflict (Verpoorten and Berlage 2007). Additionally, the risk associated with travel, even over short distances, may also weaken ties between members.

III. The Empirical Conflict Literature

Although the effects of conflict have been examined at both the micro and macro levels, conflict risk has never been explicitly considered been measured. For aggregate studies, the effects of conflict are typically measured using changes in GDP and therefore reflect the risk and

[3] Verpooten (2009) reports that cattle prices in Rwanda decreased by 50 percent during the genocide. This may be caused by the widespread sale of cattle as well as by the difficulty in protecting livestock during times of conflict.

experience of violence as well as conflict-induced changes in trade, exchange rates and foreign direct investment. Consequently, it is difficult to understand how estimates of 1.25 to 2.2% lower per capita GDP each year of conflict translate to the micro-level (Collier 1999; Imai and Weinstein 2000; Hoeffler and Reynal-Querol 2003). In particular, these studies are unable to study the distributional effects of conflict on welfare.

At the household level, the absence of measures of conflict risk leads studies to overestimates of the direct effect of violence. Since households that experience violence also suffer from its risk, the effect of *ex ante* risk management is included in the estimates of the effects of exposure to violence. At the same time, despite overestimating the effect of the experience of violence, the overall impact of violence is underestimated. Since losses are only measured in households or regions that experience violence, these studies leave out the effects of risk of violence in those households that do not experience violence. Lastly, these studies typically focus on post-conflict outcomes and find important consequences from conflict. However, they are unable to separate the mechanisms. What are the relative contributions of the violence, the *ex ante* risk mitigation or the *ex post* coping mechanisms?

To the best of my knowledge, there are no papers that formally test for the effects of conflict risk separate from the direct experience of violence; however, many results are consistent with households sacrificing returns in response to this risk. Examining rural agriculture during the conflict in Burundi, Bundervoet (2007) finds a shift from maize towards cassava production that he interprets as household increasing the share of low-risk low-return crops in their portfolio. McKay and Loveridge (2005) find similar results looking at changes in the composition of production in Rwanda pre- and post- genocide (1990 and 2000). Although they do not control for

violence, they also find that households shifted away from "risky" cash crops such as coffee and beer bananas towards "safer" crops such as cassava and Irish potatoes. Similarly, examining labor markets, Fernández *et al.* (2011) find that a shift in male labor shifted from on-farm work towards off-farm non-agricultural work. This is partially driven by the focus of Colombian violence on land and livestock, thereby making agricultural labor riskier. Examining female labor market choices in Nepal, Menon and Rodgers (2011) find increased supply in response to conflict. While they provide several reasons for this shift, one is that many men left their families (and the women) behind as they sought work and security. Similarly, examining the effect of municipal level drug trade-related violence in Mexico, Dell (2011) finds that it lowers female labor force participation and female informal sector wages.

A related literature examines peace dividends by looking at the effect of violence on housing prices (Besley and Mueller 2012; Collins and Margo 2007), and stock prices (Abadie and Gardeazabal 2003; Guidolin and La Ferrara 2007; Zussman and Zussman 2008; Zussman, Zussman, and Nielsen). These studies find strong effects of peace on prices, especially as it becomes credible, or surrounding key events such as assassinations. While these studies do not explicitly model the effects of the risk of violence, as a group, they suggest strong financial responses to conflict risk.

IV. Conflict in Northern Uganda

Although conflict in Northern Uganda pre-dates the emergence of the Lord's Resistance Army (LRA) in 1986, the rise of the LRA from the remnants of Alice Lakwena's short lived rebellion began a near-continuous cycle of violence in Northern Uganda. Initially, the LRA sought to

capitalize on the tensions between the North and the newly installed government in the center of the country, and claimed to represent the interests of the Acholi, one of the main Northern ethnic groups. The inability of the LRA to obtain support from the local population quickly led to the LRA targeting the local population for supplies and recruits. Throughout this period, attacks are fairly widespread. Representative data finds that 16, 25 and 25 percent of Northern communities suffered attacks by the LRA in 1992, 1999 and 2004 respectively (Ssewanyana *et al.* 2007).

Unlike many other insurgencies, the LRA typically did not seek to engage government forces, preferring instead to target the local population especially for forced recruitment through abductions. Youths were typically permanently abducted and forced into the LRA, while older individuals were often used as temporary porters or as guides. The length of the conflict and the absence of reliable data complicate estimates of the level of abductions, however, they are believed to range from 20,000 to 80,000 (Lomo and Hovil 2004, Pham *et al.* 2007, and Blattman and Annan 2010).

The prolonged violence resulted in several types of migration. Wealthier household were able to flee towards urban areas. Poorer groups tended to move to internally displaced persons (IDP) camps located within Northern Uganda (Fiala 2009). Additionally, since the LRA often attacked at night, a large number of children commuted nightly to the relative safety of urban areas or to the centers of IDP camps. At its peak, there were an estimated 30,000 “night commuters” (Amnesty International 2005).

Beginning in 2002, the government displaced large numbers of individuals, primarily from conflict prone areas, to IDP camps. Between voluntary and involuntary movements, certain

districts virtually emptied. For instance, by 2004, approximately 90 percent of the original populations of Gulu and Kitgum districts were no longer in their original districts (Pham *et al.*, 2005). Although the reasons for the government's choices of particular districts are not known, it is reasonable to assume that these areas were among the areas with the highest risk of future attacks. Consequently, *ex ante* losses from the risk of conflict may be underestimated as the individuals in the high risk communities were moved to lower risk communities.

V. Empirical Strategy

Building on the earlier discussion, the effects of conflict on household welfare can be thought of as being composed of two parts: the responses to risk (*Risk*: *ex ante* risk mitigation), and the effects of the shock including household responses (*Experience*: losses from both the exposure to violence and the subsequent *ex post* risk coping).

Formally, this can be estimated using the following equation:

$$(1)\ Welfare_{ij} = a + b_1 Risk_{ij} + b_2 Experience_{ij} + b_3 X_{ij} + e_{ij}$$

where the subscripts refer to community *i* and household *j*. *X* reflects the other observed factors that influence welfare. While the questionnaire contains questions regarding the exposure of communities and households to violence, there is only limited information regarding risk. Consequently, conflict-risk levels need to be estimated.

Measuring Conflict Risk

Since violence is typically not random, regions or households face different risks of exposure. Conceptually, violence can be thought of as occurring on two separate but related levels: geographic and within area. The former "placement effect" encompasses the reasons that determine which areas experience violence (see Jacoby 2000 for discussion of placement effects). In the context of conflict, the characteristics of an area, such as the physical geography or its ethnic homogeneity, may influence both its likelihood of being attacked as well as the observed outcomes. The second effect is the within community heterogeneity as even within a community that is attacked, households may face very different risks of experiencing violence. For instance, in ethnic or religious conflicts, such as genocide in Rwanda or inter-communal violence in India, this risk may vary greatly among households within a community and will therefore result in different household responses.

In this paper, the estimation of risk on the assumption that, in the context of Northern Uganda, while the risk of violence is heterogeneous at the community level, it is largely homogenous within communities. This assumption is supported by a variety of qualitative and quantitative evidence.

Although the LRA operated throughout Northern Uganda, the "placement" of its attacks was not random as it primarily operated in the Acholi districts. While the tactics and motivations of the LRA are unclear, there are several plausible explanations for this targeting such the substantial linguistic differences throughout Northern Uganda. Since the original LRA members primarily came from the Acholi districts, it was easier for the LRA to operate in these areas and to communicate with abducted individuals from these districts. Moreover, although the main bases for the LRA were in Southern Sudan, they had a number of smaller bases in the area including in

Pader district (Fiala 2009). Over time, especially after 2002, LRA attacks became more frequent in other parts of the country (Ssewanyana *et al.* 2007). This is partially the result of the forced displacement of districts by the government, thereby depriving the LRA of potential targets for supplies and abductees and forcing them to follow the migration.

In contrast to the "placement" of attacks, within community risk was largely homogenous as the evidence suggests that attacks and abductions were random within the same village, or at least uncorrelated with individual observed and unobserved characteristics. This is largely the result of the ideology of the LRA to "purify" Northern Uganda of corruption and witchcraft through violence (Allen and Schomerus 2006; Branch 2010; Titeca 2010; and Finnström 2003). Consequently, all non-LRA individuals were at potential risk of violence, abduction or death. Interviews of former LRA officers indicate that the LRA would attack any households encountered and abduct all able-bodied civilians (Blattman and Annan 2010). In particular, the former officers note that the targeted homesteads were generally unplanned and random. Crucially, this suggests that concerns of reverse causality between consumption and conflict, such as villagers reducing wealth to lower the likelihood of attacks, are unfounded.

Once a village or homestead was attacked, the LRA's "strategy was to abduct first and sort out later" (Blattman and Annan, 2010: p. 8-9). This is supported by Blattman and Annan's (2010) quantitative analysis of youth abductions using a pre-abduction representative data set for one of the most affected districts in Northern Uganda.[4] They find no statistically significant differences

[4] The Blattman and Annan study is particular unique since in most data, including the one used for this research, it is not possible to empirically verify the exogeneity of attacks. Any post-attack variables are potentially endogeneous to the violence. Additionally, since certain households or individuals may disappear from the data, the post-attack population is not representative of the pre-attack population. Consequently, any analysis requires both a pre-attack representative sample and pre-attack characteristics.

in the mean of pre-war characteristics that predict abductions in other conflicts, such as pre-war wealth or parental characteristics. The only exceptions were the year of birth and the size of the household. The former reflects the preference of the LRA for youths between the ages of 10 and 24 as forcible recruits; younger children were less useful while older youth were perceived as being difficult to indoctrinate. The significance of the size of household is driven by the sub-sample of household with 25 or more members. This is not only a rare occurrence in their data but also overall in Northern Uganda. The 2002 Uganda National Census shows that less 1 percent of households in Northern Uganda, rural or urban, have 15 or more members; in rural areas, this represents roughly 0.5% of the sample. Blattman and Annan's (2010) findings suggest that variation of individual and household characteristics within village did not affect the likelihood of being abducted.

Relationship between Objective and Subjective Risk

Two different types of risk can be estimated with the data available in this study: statistical (objective) and perceived (subjective). The former refers to the observed likelihood of a particular shock occurring while the latter to the a priori belief that a specific shock will occur. In general, the two types of risk may differ for a variety of reasons including incomplete information or behavioral biases such as the proximity or vividness of events. Moreover, within economics, Lowenstein *et al.* (2001) highlights how "emotional reactions to risk situations often diverge from cognitive assessments of those risks…[and that] when such divergence occurs, emotional reactions often drive behavior". (p. 267).

In particular, numerous studies argue that subjective risk assessments are formed through interactions between analytical and experiential systems (see Slovic *et al.* 2002 for a review of the literatures). That is, subjective risk assessments are can be broadly considered as a combination of objective risk and of individual feelings, memories and associations. Based on this relationship, statistical risk can be viewed as a measurement of perceived risk that contains measurement error (the subjective part of the expectations). Therefore, as with classical measurement error, the effects of statistical risk in the subsequent results should be lower than those the perceived risk (due to the attenuation bias towards zero).

Estimating Risk

Both objective and subjective risk are measured through questions in the community questionnaire. This questionnaire was administered through group interviews of community leaders.[5] Specifically, the objective risk measure is based on a binary question asking about "incidents of LRA Rebel attacks currently (2004)." Since this is relative to a specific event, as opposed to a belief, it is unlikely that there systematic differences between community leaders and individual household respondents. Moreover, due to its potential consequences, this is an important event that is likely well known within the village.

The second relevant question asked in which years did "any section of the community find it hard to cultivate their land in the past years because of insecurity?" The responses are limited to those who answer the current year (2004). While this question does not directly measure subject

[5] Enumerators were instructed to make certain that the respondents contained at least two men and two women and which did not exceed 10 individuals. Moreover, the group was supposed to contain at least several individuals who have lived in the community for several years and who are knowledgeable about historical events. In general, this group was supposed to be organized with the help of the local community leader (chairperson of the LC1).

perceptions regarding risk, it does measure a direct response to perceived insecurity. Since agriculture is the self-reported primary income source for the majority of respondents (~70 percent) in these rural communities, this question is a particularly good measure of household responses to insecurity.

The previous discussion regarding LRA attacks makes clear that once villages are attacked, all households are equally at risk. While this directly implies that objective risk measures are homogeneous within villages, subjective risk measures might not be as homogeneous. This is relatively little empirical evidence on heterogeneity in subjective expectations, particularly within developing countries. The only study of which I am aware suggests that across-community variation in beliefs is substantially higher than within-community variation (Doss *et al.* 2008). Moreover, the widespread attacks and abductions in the area – close to 40 percent of males and 20 percent of females aged between 14 and 30 were abducted in the most affected areas – implies that the indiscriminate strategies of the LRA were widely known (Beber and Blattman 2010).

While a variety of factors might lead to systematic difference in perceived risk levels, the data allow for controls for many of the most important. In particular, controls are included for the demographic structure of the household as those with younger members might be at greater risk of suffering a prolonged abduction, or members working in multiple locations or attending school thereby increasing the risk of abduction. Additionally, since household perceptions might be systematically related by personal histories with violence, variables for household histories of prior attacks and of prior abductions over the previous 10 years are included.

Similarly, the gender of the head of the household might influence perceptions of risk as the experience of abductees often varied based on their gender. Males often were indoctrinated and turned into fighters. Others primarily carried loads or performed domestic duties in the camps. Although some females also became fighters, they frequently were used as sex slaves or as cooks within the camps. Moreover, since these camps were located in Southern Sudan, it was typically more difficult for females to escape due to the added distance from their homes and the fewer opportunities to slip away in camps. Consequently, a control for the female headed households is also included. Although it is not possible to fully control for everything which might lead to heterogeneity of subjective beliefs within villages, based on the particular context and the included controls, the residual heterogeneity is likely small and random.

Empirically, risk is estimated at the community level using the following logistic regression:

$$(2)\ Indicator_i = f(A + BZ_i + E_i)$$

where the dependent variable, *Indicator*, is measured at the community level. As noted, for objective risk, *Indicator* is a binary variable for whether or not community *i* was attacked in 2004. In this case, the predicted value (or fitted value) from equation (2) is the estimated probability of the community experiencing an attack in 2004. For subjective risk, the dependent variable is a binary variable for whether any section of the community found it hard to cultivate their land in 2004 because of insecurity. The predicted value represents the probability that the community would report being insecure in 2004 and therefore represents subjective risk. The risk levels are predicted using the distance of community i from LRA attacks in previous year as the vector of explanatory variables, *Z*.

As noted earlier, based on the context and the included controls, the fitted values for both objective and subjective risk are arguably also largely homogenous within communities. Consequently, despite being measured at the community level, the fitted values from equation (2) are treated as measures of individual risk for the remainder of the paper.

Welfare Effects

In the second stage of the estimation, the predicted risk values from equation (2) are inserted into equation (1) resulting in equation (3):

(3) $Welfare_{ij} = a + b_1\widehat{Risk}_i + b_2 Experience_{ij} + b_3 X_{ij} + e_{ij}$

Welfare is measured as the log of per capita household expenditure for household j in community i. While household welfare can be measured using different measures, per capita consumption is arguably highly correlated with many of the alternative choices and directly linked to poverty measures. $\widehat{\text{Risk}}_i$ is a vector containing the fitted risk value and its square from the first stage (equation (2)). This choice reflects the intuition that there is a natural limit to the amount that households can decrease their expenditure. Initially, households are able to adopt a variety of strategies to reduce *ex ante* risk but that also reduce income (and expenditures). As risk increases, their ability to further adapt is limited both by the availability of strategies and by the expenditure required to survive. Due to the high correlation between measures of objective and subjective risk, equation (3) is estimated separately for each type of risk.

The vector also includes an interaction term between female head of household and the fitted value of risk. This reflects both the specific context in the Northern Uganda as well the literature.

As previously noted, the very different consequences of abduction faced by women suggest that they might be more affected by the risk of violence. There are, however, also reasons to believe that women might be relatively less affected by this risk. In contrast to men, women in Northern Uganda often remained within their villages or homesteads. Men traveled more extensively potentially giving them access to more information about neighboring attacks.[6] The broader risk literature has also examined gender difference in response to risk although no consensus has emerged (Doss *et al.* 2008).

The *Experience* vector measures the experience of violence in community i and household j. These variables are separated based on the level of aggregation (community or household). Community and household experiences of violence may differ for a variety of reasons including migration, the spatial distribution of household or even the nature of the specific attacks. Additionally, the effects of the two experiences are likely to be different. Whereas community level attacks may affect the broader economy and public goods, household attacks may lead to the destruction or theft of personal assets, the abduction or death of household members or psychological trauma.

The experiences are also divided based on the time elapsed since the shock. In particular, binary variables are included for whether community i and household j have experienced an attack from rebels since 1992. A binary variable for whether community i was attacked by rebels in 2004 is included. The survey did not contain a similar question for households. There are questions

[6] This difference was apparent in qualitative work by the author after the end of conflict. Whereas men had knowledge of abductions in the surrounding area, women often only knew the history of the village. In the extreme case, a woman did not know of the abductions in a village located less than 10 minutes away by foot.

regarding abductions in 2004 as well as abductions since 1992 which are included in the control vector, X_{ij}.

Equation (3) therefore separates the effect of *ex ante* risk exposure (b_1) from the experience of being attacked (b_2). When objective risk is used, equation (3) contains both the dependent variable and the fitted value for equation (2). Mechanically, the predicted value of risk used in equation (3) represents the part of the experience that is correlated with the proxies used in equation (2). Therefore, although the experience variable and the fitted values are highly correlated, they have distinct interpretations. The former reflects the effect of risk on expenditure while controlling for the experience of households and communities. Similarly, the latter reflects the effect of the experience of violence after controlling for risk.

The control vector, X_{ij}, contains a variety of household and community-level controls. The controls for the demographic structure of the household reflect both the differences in productivity and required consumption levels of different age groups but also their varying risk for abduction. As noted earlier, the LRA systematically targeted youth between the ages of 10 and 24. Consequently, households with members in this age group might experience greater (perceived) risk. Depending on specification, it also includes measures of productive household assets.

The data allow me to largely control for migration within rural communities or IDP camps in Northern Uganda. In particular, the migration of individual members is controlled for using a variable for the number of absent working age household members (14-60). I also control for the motivation for any migration by including binary variables for migration due to insecurity by the

head of the household in 2004 or ever. While there is no data on forced migration, this is likely included in the category for migration due to insecurity.

It is not possible to link migrants with their former communities. Consequently, the variables regarding their community's experience with violence relate to their current community. Therefore, certain households may have experienced an attack in 2004 but currently reside in a community that has not currently experienced an attack. This is part of the variation that allows for the separate estimation of household and community experiences of violence.

Households that either migrated to urban areas in Northern Uganda or which left Northern Uganda are not included in the sample. The sample is therefore only representative of non-urban rural households (including IDP households) in 2004. Since the conflict has been ongoing since 1986, it is likely that most households that could leave Northern Uganda (or even move to cities) would have left before 2004

VI. Data

The household and community data are drawn from the Northern Uganda Survey (NUS) that was administered by the Uganda Bureau of Statistics in 2004. The NUS data are one of the largest, if not the largest, representative datasets of any country during a conflict. Large surveys administered during conflicts typically omit the most dangerous areas.[7] As a result, arguably the most relevant households for studies on the effects of conflict are not included. In contrast, the

[7] For instance, despite being a nationally representative survey, the 1999/2000 Uganda National Household Survey used by Deininger (2001) omitted several conflict areas. This is based on personal correspondence with the Ugandan Bureau of Statistics.

NUS contains representative data for 386 geo-referenced rural communities and 3,867 households.

Since the empirical strategy relies on the community geographical coordinates, the data are restricted to the communities (and associated households) for which these data are available and correct[8]. Additionally, households without any consumption of food or which had abnormally high holdings of land (>200 acres as compared to mean holdings of 3.7 acres with a standard deviation of 5.4) are not included. The remaining analysis is based on 353 communities and 3,509 households for which data were available.[9]

The NUS data are supplemented with data from the Armed Conflict Location and Event Data (ACLED) for Uganda (Raleigh and Hegre 2005). The NUS data only include data on community level attacks in 1992, 1999 and 2004. By providing additional geo-referenced data for the location of LRA attacks from 1997 until 2003, ACLED allow both for a larger set of instruments and a more accurate "map" of violence. Additionally, insofar as the behavior of households changes based on their distance from violence, ACLED should result in more precise estimates of the effects of the risk of violence. The ACLED data are drawn from a variety of sources including press accounts, books, and humanitarian worker accounts. The data are disaggregated by event type, year, participants, and geographical coordinates. This paper only uses the events that are violent, include the LRA, and occurred in 2003 or earlier. Additionally, since the

[8] For 33 communities, the recorded coordinates fall outside of the boundaries of Uganda and therefore these communities have been dropped. Since this is based solely on the recorded coordinates, there is no reason to believe that any systematic differences exist in these observations.

[9] The variables for the distance to the nearest attack are an exception. These were created using all the data – rural or urban – for which correct geographical coordinates were available.

precision of the geographical coordinates varies, I only include those that are precise to the village or sub-region location and exclude those which are only recorded at the regional level.

Table 1 reports the weighted descriptive statistics for the variables used in the estimation of equation (2). LRA attack in 2004 is a binary variable for whether or not community i was attacked by rebels in 2004. Insecurity is a binary variable for whether "any section of the community found it difficult to cultivate their land in 2004 because of insecurity." This measures the perceived risk of violence within the community.

The instruments used in equation (2) are drawn from the NUS and the ACLED datasets. These measure the distance (in arc degrees) from community i to the nearest attacked community (excluding community i). For the NUS data, these are created for the rebel attacks in 2004, 1999 and 1992. The ACLED data represent the distance (in arc degrees) from community i to the nearest LRA attack in each year from 1997 to 2003. Objective and subjective risk are the fitted values for the estimation of equation (2) using the binary variables for whether community experience of violence and perceived insecurity, respectively, as dependent variables.

As can be seen in table 1, close to one third of the survey communities were attacked in 2004. A similar number of communities reported being insecure. On average, communities were relatively close to attacks by the LRA as the average distance varied between 0.20 and 0.90 decimal degrees (approximately 22 and 100 kilometers, respectively). For the closest communities, this was as low as approximately 3.6 kilometers.

Table 2 reports the weighted descriptive statistics for the variables used in the estimation of equation (3). Expenditures are measured as the natural log of per capita annual total household

expenditure, defined as the sum of food expenditures (purchased, home production, and free), non-durable goods and frequently purchased services (including rent), semi-durable and durable goods and services, and non-consumption expenditures (such as remittances and taxes). Although food aid is not directly measured, free food is used as proxy. The recall periods vary across the components of expenditure from the past week for food to the past year for semi-durables and durable goods and services as well as for non-consumption expenditures. The aggregate expenditure annualizes components and assumes that behavior over the recall period is representative for the entire year. Livestock holding are aggregated into Tropical Livestock Units[10] (TLU). Household members are defined as all household members who have lived in the house 6 months or more during the past 12 months. This also includes those who have come to stay in the household permanently even if they have lived in the household less than 12 months. Households[11] are relatively small, with only 5 members.

Household members are defined as all household members who have lived in the house 6 months or more during the past 12 months. This also includes those who have come to stay in the household permanently even if they have lived in the household less than 12 months. Regular members are defined by NUS as “close relatives and would have been usual members of the household but have been away more than six months during the last 12 months”. Regular members are not included in the household for the purposes of calculating per capita expenditure. On average, households were relatively small with only 5 members on average as compared to a national birthrate of 6.65 children per woman.

[10] Tropical livestock units are aggregated as follows: head of cattle=0.70, sheep and goats=0.10, pigs=0.20, poultry=0.01.

11 Regular members are defined by NUS as “close relatives and would have been usual members of the household but have been away more than six months during the last 12 months”. Regular members are not included in the household for the purposes of calculating per capita expenditure.

VII. Results

As discussed above, the estimates of the objective and subjective risks of attack from equation (2) are used as regressors in equation (3). By their very nature, predicted regressors are estimated with error and therefore the standard errors need to be adjusted (Pagan 1984). This is addressed using a bootstrap with 2000 replications. Typically, since the same sample is used in both stages, sampling with replacement alters the composition of the sample in both stages. This paper differs in that different levels of data are used in each stage; the first stage uses community level data while second stage uses household data. Consequently, only only the first stage is bootstrapped and the resulting 2000 estimates of risk are used in the second stage (which uses a constant sample throughout).

The estimates of the objective and subjective risks of attack are created using the coefficients from the estimation of equation (2) (table 3). In each case the independent variables measure the distance of the community from violent attacks by the LRA in various years. The errors in the logit regression are clustered at the community level. In the first column, the dependent variable is a binary variable for whether or not a community was attacked by the LRA in 2004. Consequently, as previously discussed, the predicted values represent the probability of the community being attacked in 2004, that is the objective risk. Similarly, the second column uses a binary variable for the perceived insecurity within the community. As previously noted, the fitted values from column (2) are estimates of the likelihood that the community feels insecure and therefore of the subjective risk.

Overall, while the variables are strongly jointly statistically significant, only several of the variables are individually significant, likely reflecting the multicollinearity among the instruments used. The fit of the model can be assessed by looking at what percent of attacks in 2004 are correctly classified[12] in each specification. For objective risk, this is a direct measure of accuracy since the fitted values represent the probability of being attacked in 2004. For subjective risk, it is suggestive as subjective risk is likely to be strongly and positively correlated with actual attacks. The predicted values for objective risk match very closely with the actual distribution of attacks (90.1%). The predicted subjective risk also does well albeit to a lesser degree (79.9%). These strongly imply that attacks at the community are clustered and, hence, non-random. In addition to the overall levels, the spatial distribution of objective and subjective risk at the community level are similar to those of actual attacks (Table 4). The higher subjective risk in Karamoja likely reflects the insecurity in the region associated with cattle raiders.

Table 5 presents the key results from the estimation of equation (3). The results are divided into those using objective (columns 1-3) and subjective risk (columns 4-6). All of the regressions contain the same basic set of controls[13] and the errors are clustered at the community level. The first column for each (columns 1 and 4) contains only plausibly exogenous factors that influence expenditure. The second columns introduce binary variables for each of a range of productive

[12] To calculate correct classification, the fitted values are compared with the actual values (here the binary variable for a community bring attacked in 2004). Since actual attacks are binary while the estimates of the risk are continuous and bounded by 0 and 1, values of less than 0.5 for the estimated risk are counted as 0 and values greater than 0.5 as 1 for the purpose of checking the accuracy.

[13] The controls are for prior abductions, the demographic composition of the household, the gender of the head of household, whether the household had migrated due to insecurity (in 2004 or since 1992), the highest education in the household, residence in an IDP camp, the presence of a major source of employment within 10 kilometers of the community and district fixed effects.

assets[14], a variable for the total amount of land owned, and a variable for total livestock holdings in tropical livestock units (TLU). As noted, both theory and prior empirical research suggests that asset holdings may be endogenous. Columns 3 and 6 further add interaction variables between attacks and risk. These allow the effects of risk to differ between attacked and non-attacked households and communities.

As noted earlier, the measures of risk are highly correlated with the measures of exposure to violence at the community level. This underscores the consistent significance of the risk measures across specifications and measures of risk. The coefficients for the linear and squared terms for risk are generally significant. Moreover, as expected, due to classical measurement error, both the significance and magnitude of the subjective risk estimates are relatively larger. The results, however, are qualitatively similar.

Moving to the last columns in each set of specifications, the risk-attack interaction variables are never significant, individually or jointly[15]. This suggests that the losses from risk between affected and non-affected households and communities are not significantly different. This may, however, also result from the high correlation between the interactions variables and the measures of risk and attack. This possibility is supported by observation that the inclusion of the interaction terms only increases the standard errors of the risk variables without affecting their coefficient estimates. Consequently, the remainder of the paper will focus on the specifications in columns (2) and (5).

[14] There are separate binary variables for the ownership of at least one unit of the following: a plough, a hoe, a boat, a motor vehicle, a motorbike, a bicycle, and a generator.
[15] These are only significant at 71 and 80 percent levels, respectively.

At the sample means for objective and subjective risk, risk decreased expenditure on average by 3 and 8 percent, respectively, as compared to 10 percent for prior attacks on the household. When taking into account the gender of the head of the household, the average effects decrease to approximately 2 and 6 percent for objective and subjective risk, respectively. Even within households that experience violence, risk remains an important factor as it accounts for between 17 and 38 percent of the conflict related losses. Overall, on average, conflict substantially lowers per capita expenditure (12 and 16 percent). These rates are similar in magnitude to economic effects of terrorism in the Basque country, approximately 10 percent decrease in GDP per capita, reported by Abadie and Gardeazabal (2003).

In contrast to attacks on households, attacks on communities are never significant regardless of the specification. The lack of significance is not caused by the correlation between the measures of the risk and experience of violence as the coefficients for the community-level attacks remain insignificant even when the former measures are omitted. Although several possible explanations exist for the lack of significance, it is not possible to distinguish between them. For instance, this may reflect mechanisms that allow for consumption smoothing within communities. Alternately, this may be unrelated to conflict, reflecting instead the nature of traditional livelihoods in Northern Uganda. The vast majority of individuals work on their farms or family enterprises. Only 10% of sample individuals employed rural Northern Ugandans aged 14-60 work elsewhere. The self-sufficiency of rural households and the general lack of labor markets may naturally limit community economies and, therefore, the impact of attacks on communities.

Lastly, the insignificance of community attacks may be the result of offsetting effects. On the one hand, attacks on communities may be destructive and have negative lasting consequences for

household income and consumption. On the other hand, prior attacks may lead to higher consumption as NGOs may focus their activities in previously exposed areas. The considerable effects of food aid are highlighted in the next section.

Three potential sources of concern remain. First, households are interviewed at different times of the year so households interviewed earlier in the year are less likely to have been attacked in the calendar year than those interviewed subsequently. Table 6 demonstrates the robustness of the results to this concern. Columns (1) and (3) report the results from Table 5. Control variables for the month of the survey are added in columns (2) and (4). The magnitude of the effect of risk decreases slightly although, qualitatively, the effects remain similar. Additionally, the significance of the measures of subjective decrease but they remain highly significant.

Another concern is that the bulk of expenditure may have occurred prior to attacks, particularly if attacks occur late in the year. This is examined in Table 7. Columns (1) and (3) recreate the findings from Table 5.[16] Columns (2) and (4) limit expenditure to food expenditure, the only portion of consumption for which the recall period is the past week. Since the probability of experiencing violence in the past week is close to zero, columns (2) and (4) capture only expenditure after attacks. The results for subjective risk remain largely consistent and actually increase. In contrast, objective risk is no longer significant and household experience of violence is no longer significant. Prior community experience becomes significant and is positive in column 2. Although this only occurs in one specification, this result is puzzling and may simply reflect the location of food aid.

[16] The sample size decreases as two households report no expenditure on food.

Lastly, the first stage imposes a particular structure by using a logitistic regression. The results, however, remain robust with the use of a probit or linear probability model. The results from the 2nd stage are essentially unchanged between the logit and probit specifications. With the linear probability model, the objective measure of risk is no longer significant although it retains the same magnitude as in the logit estimation.

The Impact of Food Aid

As previously noted, food aid is often directed to areas which experience violence. Consequently, the previous estimates are the "net" costs of conflict as the effect of conflict has been mitigated by the considerable food aid and the work of NGOs and government. As can be seen in table 8, these efforts were primarily located in Acholi (the most affected region) and Karamoja (the poorest region). Therefore, the estimates from table 5 reflect the effects of risk after the provision of food aid. That is, these "net" measured effects represent the effect of risk and of food aid jointly. These effects are partially visible in figure 1, where the effect of subjective risk becomes after 0.89 due to the positive coefficient on the squared term. [17]

Rough estimates of the "absolute" impact of risk, that is the impact of risk in the absence of food aid, can be derived in one of two ways. First, while there is only a limited research on the effect of food aid on household behavior, Abdulai *et al.* (2005) find that food aid does not create food production disincentive effects among recipients. Consequently, expenditures net of food aid might be a good approximation of expenditure in the absence of food aid. If food aid affects either food production or the overall levels of expenditure, then a better estimate might be

[17] This also reflects the lower density of data in this area leading to less precise estimate as well as the decreasing ability for households to limit decrease expenditure as the expenditure approaches a lower bound required for survival.

obtained using the non-IDP population. The bulk of food aid is provided in IDP camps as the median non-IDP camp household did not receive any food aid.

Table 9 provides the estimates of the absolute effects of risk. For ease of comparison, the first column for objective and subjective risk contains the full sample and replicates prior results. The second pair of columns maintains the full sample but uses expenditures net of food aid. The last pair of columns in each sample limits the sample to non-IDP camp households. The dependent variable is actual expenditures, including any food aid. The top section reports the coefficients for the risk and attack variables in each regression. The second section reports the average effect of risk on expenditures (including the effect of the gender of the head of the household where statistically significant).

Several broad results emerge. First, the objective risk variables are no longer significant in the non-IDP camp sub-samples. Although this could reflect the smaller sample size, the magnitude of the coefficients also decreases suggesting that this is not solely due to increased standard errors. In contrast, the magnitude of the measures of subjective risk increases and remains highly significant. This result reinforces the relative importance of subjective as opposed to objective risk. Households make their decisions based upon their perceptions, which may diverge from realizations to date which are used to generate the objective risk measures.

Second, the absolute impact of subjective risk is significantly higher in the alternate specifications. While neither measure is perfect, our overall confidence in the estimate is reinforced by the almost identical estimates of the absolute effects of subjective risk obtained using different exclusion rules. The average estimated absolute effect of risk increases to roughly

75% of the estimated effect of direct exposure. The increase in the average effect of risk suggests that the provision of food aid appears to erase 17-30% of the overall impact of risk.

Lastly, the effect of gender of the household on the effect of risk completely disappears in the specification that excludes households in IDP camps. This is likely explained by differences in the behavior of males and females in IDP camps that were obscured by the high correlation between risk and IDP camps status. The increase in both magnitude and significance of the coefficient in the 2nd specification implies that this is not due to food aid being targeted towards women or female-headed households. Rather, this means that female-headed households have relatively higher expenditure in IDP camps. Lehrer (2010) suggests that this is driven by productivity differences as a gendered work culture tended to develop in IDP camps. Women frequently worked while men were less likely to work and spent their days drinking, playing cards and talking.

Aggregate Effects and Spillovers

Although the estimated effect of the risk of violence is smaller than that of its experience, only a modest fraction of the overall population experience violence. In contrast, the risk of exposure affects virtually the entire population. Consequently, the aggregate effects of risk are considerably higher than implied by cursory comparisons of their estimated coefficients. Table 10 provides a rough estimate of the contributions of the risk of violence and its realization to the aggregate costs of conflict. These are calculated using the coefficients estimated in Table 9 for risk (linear, squared and female headed household when statistically significant), the mean

household levels of risk, and the aggregate income by exposure status and gender of the head of household.

The first two columns examine the actual effect of risk. Even in the lower estimate using objective risk, on aggregate, risk accounts for more than 40% of the overall estimated costs of violence. Moreover, there are strong spillovers of risk from those households that have experienced violence to those that have never experienced it; close to a quarter of the overall losses and more than 60 percent of the losses from risk occur in non-directly affected households. When subjective risk is used, the losses from risk are 64% higher than losses due to the experience of violence and losses in houses that have never been attacked exceed those from "direct" losses from attacks. These effects only increase when the "absolute" effects of risk are used. Over 40% of the overall losses occur through spillovers and risk accounts for close to 70% of the overall losses.

The aggregate household losses attributable to conflict are substantial with estimates ranging from 0.4 to 0.9 percent of GDP for 2004. Consequently, risk lowered aggregate expenditures by 15 to 66 million US dollars and spillovers accounted for 9 to 51 million dollars. To put these totals into perspective, in 2004, disbursed ODA aid from DAC countries to Uganda amounted to roughly 684 million US dollars. Although it is not possible to solely isolate aid directed to Northern Uganda or resulting from conflict, the stated purpose of individual grants allow for an upper bound of 126 million US dollars to be calculated. The bulk of the disbursed aid, 102 million US dollars, is categorized as emergency food aid or as food security programmes/food aid and is likely partially used in areas outside of Northern Uganda.

These losses have accumulated and compounded throughout the conflict. Roughly half of the 0.5 to 0.9 GDP losses in 2004 are due to the risk of violence. Over the length of the conflict, this translates into 4.6 to 8.2 percent lower GDP due to the risk of violence. At the household level, the effects are substantially larger since the most of Uganda was not affected by this conflict. Using the estimate for the subjective risk specification (6.2 percent lower per capita expenditure), the risk of violence lowered expenditure levels by 70 percent over the course of the conflict. This likely represents a lower bound estimate as the ability of household to reduce expenditure likely reduces as household expenditure decreases. Consequently, as households became poorer, their ability to mitigate risk decreased leading to weaker expenditure responses to risk. Since the losses compound over time, even small changes in risk-related losses may lead to substantially higher levels of welfare of time. For instance, reducing average losses from 6.2 to 3.1 percent per year reduces the lost per capita expenditure from 70.4 to 45 percent over the course of the conflict.

VIII. Conclusion and Policy Implications

This paper has examined the effect of the risk of violence on welfare, as proxied by per capita expenditure, in Northern Uganda. Depending on the specification, I find that risk reduces per capita expenditure by 2 to 6 percent and accounts for roughly half of the overall costs of conflict. Within households that experience violence, risk still accounts for between 17 and 38 percent of percent of welfare losses. The effects of risk are not limited to households that have experienced violence as risk-related losses in household that have never been attacked account for roughly 40 percent of the overall costs of conflict and 60 percent of the losses due to risk. In aggregate, household risk-related losses account are roughly equal to 0.5% of GDP. This suggests that prior

studies that focus solely on exposure to violence both substantially underestimate its costs as well as ignore one of the more important pathways from conflict to the outcomes observed during and post-conflict.

Compounding these losses over the length of the conflict suggests substantial losses at the national level, 4.6 to 8.2% lower GDP, and individual levels, -70% per capita expenditure, due to the risk of violence irrespective of the experience of violence. Despite their size, these losses likely represent a lower bound of losses due to conflict risk. Over time, the ability of household to respond to risk has decreased as household have become poorer (currently the poverty rate is over 70%). Since losses compound over time, even measures which lead to limited decreases in risk-related losses can lead to substantial welfare improvements over time.

The evidence also suggests that food aid appears to be partially effective as it reduce the overall losses attributable to risk by 18 to 30 percent. This suggests an important role for food aid in a period where food aid totals have substantially decreased despite the prevalence of low levels conflicts throughout the development world. Moreover, the strong spillovers of losses into households and areas that do not directly experience violence suggests that aid should not be limited to IDP camp populations although this needs to be balanced with obvious safety concerns for humanitarian workers.

These results suggest that perceptions of risk may be just as important. Careful monitoring of these may allow for proactive responses as opposed to waiting for losses to accumulate. The importance of risk and the limited ability of households and communities to address this risk suggest an important role for government policy. For instance, the loss of customers due to the

crisis and violence surrounding the 2007 Kenyan election and the inability of informal insurance networks to compensate led to an increase in unprotected sex by sex workers both during and immediately after the crisis (Dupas and Robinson 2011).

While these results underline the importance of responses to risk, these data are rarely available even in non-conflict data. In contrast, there has been a strong increase in the availability of spatially and temporally disaggregated data on acts of violence. This paper has introduced a simple methodology to obtain disaggregated measures of objective risk using this newly available data. While the measures of objective risk are not as strong as those of subjective risk, their results are qualitatively similar suggesting that this methodology can be used examine responses to conflict risk in other settings.

While the LRA is no longer active in Northern Uganda, the population is only slowly beginning to recover from nearly two decades of violence, fear, and uncertainty. Importantly, as subjective risk levels decrease, the process that led to lower welfare during the conflict will reverse itself. Although this process will not be without difficulties, the resilience of Northern Uganda after two decades of conflict suggests that they are up to the task.

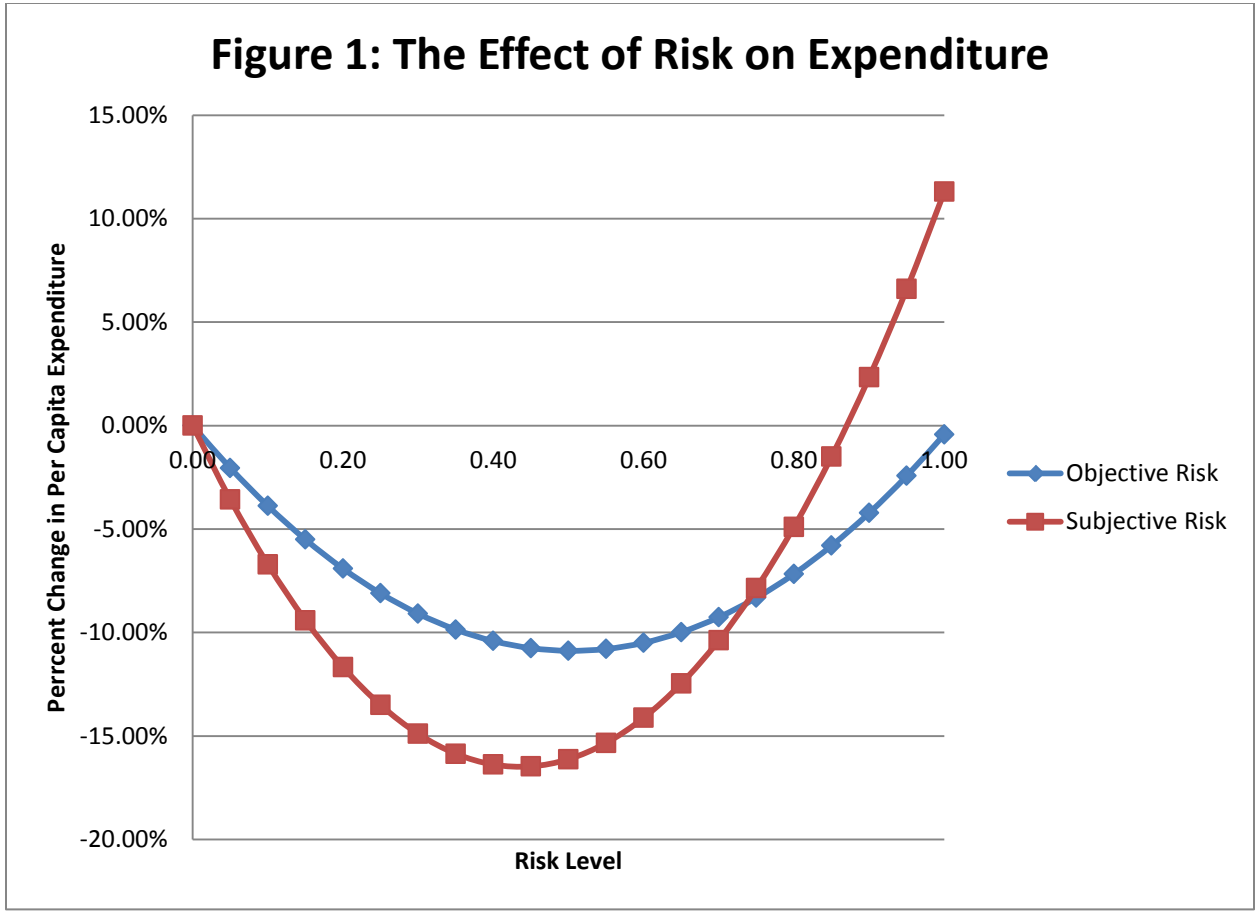
Figure 1: The Effect of Risk on Expenditure
15.00%
10.00%
5.00%
0.00%
-5.00%
-10.00%
-15.00%
-20.00%
0.00
0.20
0.40
0.60
0.80
1.00
Perrcent Change in Per Capita Expenditure
Risk Level
Objective Risk
Subjective Risk

Table 1: Descriptive Statistics for Variables in Equation 2

Variable	Mean	Median	SD	Min	Max	Source
LRA attack in 2004 (1=yes)	0.30	0.00	0.46	0.00	1.00	NUS
Hard to cultivate land due to insecurity in 2004 (1=yes)	0.28	0.00	0.45	0.00	1.00	NUS
Fitted value using LRA attack in 2004	0.30	0.06	0.37	0.00	0.98	-
Fitted value using hard to cultivate land	0.28	0.16	0.29	0.00	0.98	-
Distance to nearest attack 2004 (decimal degrees), NUS	0.34	0.26	0.28	0.00	1.09	NUS
Distance to nearest attack 1999 (decimal degrees), NUS	0.28	0.20	0.25	0.00	1.25	NUS
Distance to nearest attack 1992 (decimal degrees). NUS	0.31	0.24	0.26	0.00	1.37	NUS
Distance to nearest attack 1997 (decimal degrees), ACLED	0.83	0.79	0.51	0.02	2.43	ACLED
Distance to nearest attack 1998 (decimal degrees), ACLED	0.44	0.33	0.34	0.00	1.36	ACLED
Distance to nearest attack 1999 (decimal degrees), ACLED	0.86	0.90	0.49	0.01	2.22	ACLED
Distance to nearest attack 2000 (decimal degrees), ACLED	0.92	0.78	0.58	0.00	2.49	ACLED
Distance to nearest attack 2001 (decimal degrees), ACLED	0.69	0.68	0.47	0.01	2.11	ACLED
Distance to nearest attack 2002 (decimal degrees), ACLED	0.37	0.26	0.34	0.00	1.60	ACLED
Distance to nearest attack 2003 (decimal degrees), ACLED	0.21	0.14	0.20	0.00	0.95	ACLED

Author's calculations using the 2004 Northern Uganda Survey. Weighted using community level weights.

Table 2: Descriptive Statistics for Variables in Equation 3

Variable	Mean	Median	SD	Min	Max	Source
Expenditure, ln(per capita annual HH exp)	12.10	12.07	0.66	8.66	15.61	NUS
Objective Risk	0.29	0.06	0.37	0.00	0.98	-
Subjective risk	0.26	0.16	0.29	0.00	0.98	-
Community, LRA attack in 2004 (1=yes)	0.29	0.00	0.45	0.00	1.00	NUS
Community, LRA attack since 1992 (1=yes)	0.45	0.00	0.50	0.00	1.00	NUS
HH attacked since 1992	0.43	0.00	0.49	0.00	1.00	NUS
Any abduction in 2004 (1=yes)	0.00	0.00	0.05	0.00	1.00	NUS
Any abduction since 1992 (1=yes)	0.06	0.00	0.23	0.00	1.00	NUS
Number of disabled in HH	0.31	0.00	0.57	0.00	6.00	NUS
Female head of HH	0.31	0.00	0.46	0.00	1.00	NUS
Total number in HH younger than 14	2.61	3.00	1.95	0.00	12.00	NUS
Total number in HH between 14-60	2.28	2.00	1.33	0.00	9.00	NUS
Total number in HH older than 60	0.20	0.00	0.47	0.00	3.00	NUS
Total number in HH older than 60	0.06	0.00	0.28	0.00	3.00	NUS
Number of non-HH members residing in HH	0.02	0.00	0.16	0.00	4.00	NUS
Some schooling but did not finish primary (1=yes)	0.53	1.00	0.50	0.00	1.00	NUS
Finished primary (1=yes)	0.14	0.00	0.35	0.00	1.00	NUS
Some secondary schooling (1=yes)	0.17	0.00	0.37	0.00	1.00	NUS
Finished secondary (1=yes)	0.01	0.00	0.09	0.00	1.00	NUS
Specialized degree or diploma (1=yes)	0.05	0.00	0.22	0.00	1.00	NUS
Finished tertiary (1=yes)	0.00	0.00	0.05	0.00	1.00	NUS
No answer for schooling (1=yes)	0.00	0.00	0.06	0.00	1.00	NUS
Head of HH migrated due to insecurity, 2004 (1=yes)	0.02	0.00	0.15	0.00	1.00	NUS
Head of HH migrate due to insecurity, ever (1=yes)	0.22	0.00	0.41	0.00	1.00	NUS
Currently reside in an IDP camp (1=yes)	0.17	0.00	0.37	0.00	1.00	NUS
Community <10 km of major employment source (1=yes)	0.14	0.00	0.35	0.00	1.00	NUS
Converted livestock units into TLU	1.33	0.20	4.80	0.00	141.15	NUS
Own at least one plough (1=yes)	0.12	0.00	0.32	0.00	1.00	NUS
Own at least one hoe (1=yes)	0.23	0.00	0.42	0.00	1.00	NUS
Own at least one boat (1=yes)	0.00	0.00	0.07	0.00	1.00	NUS
Own at least one vehicle (1=yes)	0.00	0.00	0.03	0.00	1.00	NUS
Own at least one motorbike (1=yes)	0.01	0.00	0.08	0.00	1.00	NUS
Own at least one bicycle (1=yes)	0.39	0.00	0.49	0.00	1.00	NUS
Own at least one generator (1=yes)	0.00	0.00	0.03	0.00	1.00	NUS
Sum of acres of land in 3 largest plots	3.70	2.00	5.37	0.00	88.00	NUS

Weighted using household weights

Table 3: Logit Estimating Objective and Subjective Risk of Community Attacks

	Obj	**Subj**
Distance to nearest attack 1992. NUS	3.14	-0.20
	[3.14]	[1.91]
Distance to nearest attack 1999, NUS	-5.19	1.33
	[5.13]	[2.28]
Distance to nearest attack 1997, ACLED	2.78	8.31***
	[2.11]	[1.88]
Distance to nearest attack 1998, ACLED	-2.94*	-2.54*
	[1.79]	[1.48]
Distance to nearest attack 1999, ACLED	-0.50	-8.30
	[2.20]	[2.27]
Distance to nearest attack 2000, ACLED	-1.08	0.94
	[1.59]	[1.58]
Distance to nearest attack 2001, ACLED	-2.45	0.87
	[2.51]	[1.97]
Distance to nearest attack 2002, ACLED	-0.27	-5.25**
	[3.08]	[1.91]
Distance to nearest attack 2003, ACLED	-16.2***	-1.48
	[5.08]	[1.97]
Constant	3.18***	0.36
	[1.16]	[0.49]
Observations	353	353
Pseudo R^2	0.58	0.35
Percent of LRA attacks in 2004 correctly classified	90.1%	79.9%

Standard errors in brackets are bootstrapped with 2,000 replications.
Community weights used

*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 4: Attacks and Predicted Risk in Rural Northern Uganda

	Community Attacked in 2004	Predicted Risk	
		Objective	Subjective
West Nile	0.02	0.07	0.08
Acholi	0.87	0.82	0.61
Lango	0.53	0.49	0.34
Teso	0.17	0.16	0.23
Karamoja	0.20	0.22	0.40
Total	0.30	0.30	0.28

Table 5: The Effects of the Risk and Realization of Violence on the Log of Household per Capita Expenditure

	Objective			Subjective		
	(1)	(2)	(3)	(4)	(5)	(6)
Risk of community being attacked, 2004	-0.52**	-0.43*	-0.45**	-0.70***	-0.76***	-0.71***
	[0.23]	[0.23]	[0.23]	[0.26]	[0.26]	[0.26]
Square of risk of community being attack, 2004	0.50**	0.43**	0.35	0.80***	0.87***	0.90***
	[0.22]	[0.22]	[0.23]	[0.28]	[0.28]	[0.27]
Risk*Female	0.15**	0.13*	0.13*	0.17*	0.16**	0.16**
	[0.07]	[0.07]	[0.07]	[0.09]	[0.08]	[0.08]
Community attack in 2004	0.02	-0.01	-0.03	-0.01	-0.03	-0.03
	[0.05]	[0.04]	[0.06]	[0.05]	[0.04]	[0.07]
Community attacked since 1992	0.04	0.05	0.04	0.02	0.04	0.03
	[0.04]	[0.04]	[0.05]	[0.04]	[0.03]	[0.04]
HH attacked since 1992	-0.09**	-0.10***	-0.12***	-0.09***	-0.10***	-0.05
	[0.04]	[0.03]	[0.04]	[0.03]	[0.03]	[0.05]
Productive Assets		X	X		X	X
Interaction terms between attacks and risk			X			X
Observations	3509	3509	3509	3509	3509	3509
Pseudo R^2	0.35	0.38	0.38	0.35	0.38	0.38

The full regressions are reported in Appendix 1

The regressions included control for household composition, migration, highest education, IDP camp residence

The regressions also control for the presence of a major source of employment within 5 km

Standard errors in brackets are bootstrapped with 2,000 replications. Household weights used. Models include district fixed effects, and clusters errors by district.

*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 6: Robustness check for time of interview

	Objective Risk		Subjective Risk	
	(1)	(2)	(3)	(4)
Risk of community being attacked, 2004	-0.43*	-0.42*	-0.76***	-0.65***
	[0.23]	[0.22]	[0.26]	[0.26]
Square of risk of community being attack, 2004	0.43**	0.42**	0.87***	0.76***
	[0.22]	[0.21]	[0.28]	[0.28]
Risk*Female	0.13*	0.13*	0.16**	0.16**
	[0.07]	[0.07]	[0.08]	[0.08]
Community attack in 2004	-0.01	-0.002	-0.03	-0.02
	[0.04]	[0.04]	[0.04]	[0.04]
Community attacked since 1992	0.05	0.06	0.04	0.05
	[0.04]	[0.04]	[0.03]	[0.04]
HH attacked since 1992	-0.10***	-0.09***	-0.10***	-0.09***
	[0.03]	[0.03]	[0.03]	[0.03]
Control for month of interview		X		X
Average effect of risk on expenditure	-2.0%	-1.7%	-6.2%	-5.0%
Observations	3509	3509	3509	3509
Pseudo R^2	0.38	0.38	0.38	0.38

The regressions included control for household composition, migration, highest education, IDP residence
The regressions also control for the presence of a major source of employment within 5 km
Standard errors in brackets are bootstrapped with 2,000 replications. Household weights used and models include district fixed effects, and clusters errors by district.
*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 7: Robustness check using only expenditure from past 7 days

	Objective Risk		Subjective Risk	
	(1)	(2)	(3)	(4)
Risk of community being attacked, 2004	-0.43*	-0.50*	-0.75***	-0.81***
	[0.23]	[0.29]	[0.26]	[0.29]
Square of risk of community being attack, 2004	0.43**	0.41	0.86***	0.99***
	[0.22]	[0.27]	[0.28]	[0.3]
Risk*Female	0.13*	0.16	0.16**	0.17*
	[0.07]	[0.08]	[0.08]	[0.1]
Community attack in 2004	-0.01	-0.02	-0.03	-0.07
	[0.04]	[0.06]	[0.04]	[0.05]
Community attacked since 1992	0.05	0.08*	0.04	0.06
	[0.04]	[0.05]	[0.03]	[0.04]
HH attacked since 1992	-0.10***	-0.04	-0.10***	-0.04
	[0.03]	[0.04]	[0.03]	[0.04]
Limit to only expenditure in past week		X		X
Average effect of risk on expenditure	-2.0%	-12.8%	-6.2%	-7.2%
Observations	3507	3507	3507	3507
Pseudo R^2	0.38	0.24	0.38	0.24

The regressions included controls for household composition, migration, highest education, IDP camp residence

The regressions also control for the presence of a major source of employment within 5 km
Standard errors in brackets are bootstrapped with 2,000 replications. Household weights used. Models include district fixed effects, and clusters errors by district.

*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 8: Relief Efforts in Northern Uganda

	Free food as percent of total expenditures*	Food distribution by within 5km of village center**	Mean Objective Risk**	Mean Subjective Risk**
West Nile	4.1%	6.6%	7.4%	8.4%
Acholi	11.3%	35.3%	82.4%	61.0%
Lango	2.7%	0.8%	49.4%	34.1%
Teso	3.8%	7.2%	16.3%	22.6%
Karamoja	7.6%	35.5%	21.8%	40.3%
Rural	5.0%	11.5%	30.4%	28.1%

* Weighted at household level

** Weighted at community level

Table 9: Estimating the Actual and Absolute Effects of the Risk of Violence

	Objective			Subjective		
	All	**Net Exp**	**No IDP**	**All**	**Net Exp**	**No IDP**
Risk	-0.43*	-0.48**	-0.31	-0.76***	-0.83***	-1.06***
Risk squared	0.43**	-0.48**	0.27	0.87***	0.91***	1.44***
Female headed household * risk	0.13*	0.16**	0.05	0.16**	0.19**	0.04
Household attacked since 1992	-0.10***	-0.10***	-0.12***	-0.10***	-0.10***	-0.11***
Average effect of risk on expenditure	-2.0%	-2.6%	-0.2%	-6.2%	-7.4%	-7.9%
Sample Size	3509	3509	2869	3509	3509	2869

*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 10: Aggregate Costs of Conflict in Northern Uganda for 2004

		Actual Effect		Absolute Effect (Subj)	
		Obj	**Subj**	**No Aid**	**No IDP**
HH never attacked (% of total cost)		25.2%	40.5%	43.2%	69.9%
	From Attack	-2.6%	1.8%	0.3%	5.2%
	From Risk	27.9%	38.7%	42.9%	64.6%
HH attacked		74.8%	59.5%	56.8%	30.1%
	From Attack	58.6%	36.0%	31.6%	11.2%
	From Risk	16.2%	23.5%	25.2%	19.0%
Total					
	From Attack	55.9%	37.9%	31.8%	16.4%
	From Risk	44.1%	62.1%	68.2%	83.6%
Total cost (Million Sh)		60,250	128,481	135,199	137,356
% of GDP		0.4%	0.8%	0.9%	0.9%

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CHAPTER 3

LIVING WITHIN CONFLICTS: RISK OF VIOLENCE, LIVELIHOODS, PORTFOLIO CHOICE AND RETURNS

I. Introduction

The theoretically strong and potentially costly responses of households to insecurity have been recently confirmed empirically and are believed to represent at least half of the aggregate household costs of conflict (Rockmore (2011). Moreover, since only a fraction of households directly experience violence during conflict, these responses to risk likely also underlie many of the adverse conflict and post-conflict outcomes in the literature (consumption: Ibáñez and Moya, 2010; Rockmore 2011; education: Akresh and de Walque 2011; Shemyakina 2011; and nutrition/health: Akresh *et al.* 2011, forthcoming; Minoiu and Shemyakina forthcoming). Since households frequently engage in a range of activities, responses to insecurity likely occur along both the intensive and extensive margins. Consequently, a comprehensive examination of adjustments to the overall livelihood portfolios is needed to understand household responses to insecurity (i.e., the risk of violence) and to design appropriate policy responses. Unfortunately, no such comprehensive empirical study exists; the current literature only focuses on specific responses, such as labor market outcomes, and therefore provides only a limited view of the overall behavioral responses (and potential tradeoffs) by households.

This paper helps to bridge this gap by providing the first empirical examination of household portfolios during conflict by focusing on the behavior of rural households in Northern Uganda. In doing so, it extends the current literature in three important ways. First, in contrast to the

current fragmented view of household responses to insecurity, I investigate how the risk of violence affects the overall choice of activities (sources of incomes and labor market participation), and the composition of portfolios (i.e., the choice of crops and livestock) within the dominant activity, agriculture. Additionally, the impact of conflict risk on returns to assets is estimated and used to separate the effects of household responses to insecurity from those of broader general equilibrium effects.

Second, while the literature discussed changes in household behavior changes during conflict, these analyses have not included measures of insecurity. Consequently, the resulting estimates necessarily combine effects of both of the risk and realization of violence. Following Rockmore (2011), the spatial-temporal placement of violence is used to estimate spatially disaggregated measures of conflict-risk and to separate the effects of insecurity from that of the experience of violence.

Lastly, since most of the variation in the "placement" of violence is across geographical regions, the risk of violence is necessarily correlated with a variety of other factors that influence the relevant outcomes. While this can be overcome with geographic fixed effects, the remaining variation in the risk of violence makes it difficult to accurately identify the impacts of (the risk of) violence in conventional samples. Unlike existing studies on the micro-consequences of conflict which rely on either qualitative evidence or small samples, many of the results in this paper are derived from a unique data set of over 690,000 rural households, accounting for 75 percent of all rural households in Northern Uganda.

Looking at overall livelihood portfolios, I find that conflict has only a limited effect on the principal sources of income of households. Rather, much of the effects of conflict occur with

these livelihoods. Labor market responses seem to be concentrated among men. Many of the strongest changes from insecurity occur within the livestock and crop portfolios. For instance, both the composition and size of livestock are substantially affected. In particular, livestock portfolios shift from large to small livestock, matching expectations as smaller livestock are less risky since they are less exposed than larger grazing livestock. On average, the value of livestock herds drop by two thirds. Moreover, the higher expected returns to larger livestock suggest that household forego income as a result of this shift in the livestock portfolio. While there are similarly strong responses in cropping patters, the pattern does not seem to match the shift the shift towards lower risk crops suggested by the literature. One possible explanation for the observed outcomes is that conflict and insecurity constrain the available labor and oxen available and therefore induces shifts to less labor/draught intensive crops.

Returning to Rockmore's (2011) estimation of the cost of insecurity, I find that the impact of the risk of violence on consumption levels disappears once I control for the allocation of asset portfolios. Along with the other evidence, this suggests that the primary pathway from conflict-risk to lower consumption is in portfolio choice as opposed to either returns to capital or general equilibrium effects. More broadly, there is little evidence of conflict-risk affected assets returns outside of human capital.

The remainder of the paper is organized as follows. Section II describes how livelihoods may respond to violence, which underlies the conceptual framework in Section III. The background and data are described in Sections IV and V, respectively. Section VI presents the methodology and the results and Section VII concludes.

II. Household Responses to Conflict

Although responses to conflict and its risk have been discussed (Dercon 2008; Justino 2009), these effects have only been recently quantified. Rockmore (2011) uses the spatial-temporal variation in the placement of violence in Northern Uganda to estimate community-level risk levels. In doing so, he separates the effects of violence into two components: the cost associated with risk and the combined effects of the shock and *ex post* responses. At the aggregate level, risk accounts for roughly half of the overall losses. The analysis does not consider, however, which factors underlie these outcomes. Ibáñez and Moya's (2010) examination of populations displaced by violence in Columbia suggests that costly risk coping strategies may be an important factor. The authors disaggregate the effects of the displacement and conflict shock into permanent and transitory components. They find that the transitory component is particularly important in explaining the lower consumption and interpret this as reflecting the disruption of risk sharing mechanisms and costly coping mechanisms. In support of this, they find increased participation of children in labor markets and a higher likelihood that household members are distributed geographically.

Several recent papers have continued to focus on (costly) adjustments through labor markets. Fernández *et al.* (2011) find the labor markets adjust as men shifted from on-farm work towards off-farm non-agricultural work. This is partially driven by the focus of Colombian focus on land and livestock, thereby making agricultural labor riskier. In contrast, women are unable to find jobs in the formal sector. Since labor markets are unable to fully absorb the labor, this response is not completely effective in addressing consumption losses. Menon and Rodgers (2011) similarly examine female labor market choice in Nepal and find increased supply in response to conflict. While they provide several reasons for this shift, one is that many men left their families (and the women) behind as they sought work and security.

Both sets of authors suggest that responses, at least partially, depend on perception of riskiness – in Colombia, the agricultural sector was viewed as riskier so people moved to non-agricultural sector; in Nepal, men were viewed as being at greater risk so they migrated leading women to participate more. These responses to risk, however, are not necessarily only reflected in labor markets and are also likely to be also present in agricultural portfolios. Moreover, since off-farm non-agricultural opportunities may be limited in many areas with conflict, labor market shifts may be less feasible.

The economics literature on non-labor (rural) household responses to the risk of violence can be divided into two strands.[18] The first strand attempts to isolate the effects of conflict, typically on investment decisions. These studies do not differentiate between the effects of the risk of violence from its realization nor do they address potential heterogeneity in the selection into violence (e.g Deininger 2003; Singh 2011). Grun's (2008) study of household investment and asset composition is notable for recognizing the potential non-random assignment of violence at the municipal level. While she attempts to control for the geographical placement of violence, she makes the strong assumption that exposure at the individual level is exogenous to individual asset holdings and composition.

A second strand of the literature documents and describes the effects of conflict (combining both the risk and realization of conflict risk) on crop, livestock and asset portfolios. This evidence suggests several consequences. Not only are there changes to overall production levels, but there is strong evidence to suggest shifts in the composition. In particular, a number of studies find

[18] I do not address the literature on migration as I focus on responses conditional on the risk of violence. Having migrated, households fit into two categories. Either they still experience the risk of violence and then may respond as discussed here. Alternately, they no longer experience any such risk and therefore are not the focus of this paper.

evidence consistent with households increasing the share of low-risk, low-return activities (Finnström 2003; Bundervoet 2007; McKay and Loveridge 2005; Vlassenroot 2008).

In particular, rural households may value crops whose harvest can be delayed during periods of insecurity (e.g., root crops), which require little attention (e.g., calabashes) or which are difficult to loot (e.g., rice) (Finnström 2003). In contrast, more lucrative crops, such as fruits or vegetables, need to be harvested with a short period of time (and are easily looted) and may force households to choose between venturing to exposed fields to harvest and remaining in the relative safety of their village.

Similar responses have been found in other conflict-affected countries in Sub-Saharan Africa. In the Democratic Republic of Congo (DRC), between 1996 and 2004, general food production decreased by 12% but vegetable and cereal production dropped by 42% and 33%, respectively (Vlassenroot and Raeymaekers 2008). Additionally, there are shifts from intensive cultivation and perennial crops to low-risk and seasonal crops such as green peas and bananas (Vlassenroot 2008). Vlassenroot notes that "agricultural production had become driven more by the push to minimize [conflict-related] risk than to maximize profit" (p. 210). Similarly, studies in Burundi (Bundervoet 2007) and Rwanda (McKay and Loveridge 2005) find crop production shifting away from "risky" crops and cash crops, such as maize, coffee and beer bananas, towards "safer" crops such as cassava and potatoes. Despite these responses, in areas where food markets still exist, household may not completely retreat to subsistence farming (OCHA 2005).[19]

The size and composition of livestock holdings may also respond to conflict risk. Large livestock, such as cattle, need to graze and may further expose household members. In contrast,

[19] OCHA's study of the Beni and Lubero areas in the DRC finds that while close to 54 percent of food production is auto-consumed and another 11 percent is used as seeds, a large portion, 27 percent, is sold.

smaller livestock, such as goats or swine, can be kept within villages or individual compounds and are also more easily hidden. Within the DRC, Vlassenroot and Raeymaekers (2008) find that livestock activity shifted from cattle-raising to small livestock activity with cattle decreasing by more than half with other studies reporting similar shift towards small livestock (Raeymakers 2008). The risk associated with important peacetime assets, such as cattle, is illustrated by the experience of Northern Uganda. Between 1985 and 1997, the cattle of population of the two of the most affected districts decreased by 98.2 percent (from 285,000 to 5,000), primarily due to raiding by rebels or neighboring cattle raiding communities (Gersony 1997). More broadly, during the genocide, cattle prices in Rwanda decreased by 50 percent (Verpooten 2009). This reflects both distress sales of cattle and the difficulty in protecting (large) livestock during conflicts.

Within Northern Uganda, Stites *et al.* (2006) report a shift towards pigs in Acholi districts for a variety of reasons: (1) pigs can be kept inside villages thereby avoiding the need to send boys to herd them outside of villages; (2) rarely targeted during raids since the nearby cattle raiders did not raid pigs while the insurgent group were banned from eating it; (3) changes in the availability of fodder; (4) reducing the concentration of wealth in a single asset (cattle).

Beyond changing the composition of crops and livestock, conflict can also reduce the returns associated with particular activities or portfolio allocations. For instance, returns to labor may decline as more remunerative permanent employment opportunities may give way to casual labor. Within agriculture, yields may decrease for a variety of reasons such as premature harvesting to reduce the risk of pillage, decreased fertilizer use resulting lower soil quality, and the inability to fallow fields (Vlassenroot 2008). In Northern Uganda, Stites *et al.* (2006) note

that as (perceived) insecurity increased, villages might be temporarily abandoned as some/all villagers spent the night in the bush or, if possible, in nearby hills. Other villages were only inhabited during planting and harvesting times although this was risky as attacks increased during this period due to the availability of supplies to loot and individuals to abduct. These responses also suggest decreased production efficiency due to perceived risk.

III. Framework for Identifying Behavioral Responses to Conflict Risk

The observed behavior suggests a framework for identifying responses which aims to disaggregate responses as changes at the extensive and intensive margins (e.g., levels and composition of assets versus the returns to these assets) or by broader general equilibrium effects. Conceptually, the changes in consumption levels induced by can be thought of as resulting from (1) $\Delta Assets$: changes in the levels or composition of assets due to risk, which includes changes in savings rates; (2) $\Delta Activity$: changes in the choice or intensity of activities due to risk; (3) $\Delta Returns\ to\ Assets\ or\ Activities$: changes in the returns due to risk; and (4) $\Delta Other\ Effects\ of\ Risk$: this includes other non-measured pathways from risk to consumption including general equilibrium effects such as changes in overall demand and supply of goods.[20]

The remainder of the paper uses this framework to examine the impact of risk on household behavior and, ultimately, on household consumption. Insofar as possible, each aspect is examined separately before estimating a model similar to (1) to understand the effects of the risk of violence in rural Northern Uganda.

IV. Conflict in Northern Uganda

[20] The general equilibrium effects (GE) in the other pathways exclude those GE effects captured in the changing returns.

While Uganda has experienced a variety of internal conflicts since independence, the conflict in Northern Uganda lasted from 1986 until 2008 with only briefs respites. The Lord's Resistance Army (LRA) was formed by Joseph Kony from the remnants of Alice Lakwena's Holy Spirit Movement which had sought to replace the national government in Kampala along with elements of other insurgent groups. While the LRA initially sought support from the Acholi, one of the main ethnic groups in Northern Uganda, the local population did not support them. As a result, the LRA raided local communities for supplies and forced recruits. These raids were widespread during the conflict as representative data suggests that 19, 25 and 25 percent of Northern Uganda communities were attacked in 1992, 1999, and 2004 respectively (Ssewanyana *et al.* 2007).

The prolonged conflict resulted in a variety of responses by Northern Ugandans. While the conflict led to voluntary migration, the number of internally displaced persons (IDP) increased substantially beginning in 1996 when the government forced the populations of the most affected regions into IDP camps (Fiala 2009). At their peak, approximately 1.8 million persons lived in IDP camps and many districts were virtually emptied (IDMC 2010).

The evidence suggests that while the risk of violence is heterogeneous at the community level, it is largely homogenous within communities. As a result, an identifying assumption in the paper is that this risk need only be estimated at the geographic level although I also control for factors which might lead to within-village heterogeneity. Consequently, insofar as the (perceived) risk of violence is not largely homogenous within communities, the measure of risk estimates village-level average effects of risk.

The indiscriminate nature of the violence emerges in interviews with rebel commanders who note that their strategy was to attack and capture as many people and then to sort them out later

(Blattman and Annan 2010). This reflects the ideology of the LRA to "purify" Northern Uganda of corruption and witchcraft through violence (Allen and Schomerus 2006; Branch 2010; Titeca 2010; and Finnström 2003). An analysis of representative[21] data from two of the most affected districts finds quantitative support for this view. Using recall data on household and community characteristics, Blattman and Annan find no significant differences in the means of abducted and non-abducted youths with the exceptions of the age of the individual and the size of the household. The former reflect the preference of the LRA for children old enough to be militarily useful but also sufficiently young to be controlled. The importance of the size of the household is due to households with 25 or members, a rare occurrence in Northern Uganda. For instance, in the 2002 Census, only 0.1% of rural households in Northern Uganda reported having 25 of more members. This suggests, that conditional of being with a village during an attack, abductions (and presumably exposure to violence) by the LRA were largely exogenous of individual and household characteristics.

In contrast, the "geographic placement" of attacks by the LRA was not random. Although the LRA operated throughout Northern Uganda, it primarily operated in the Acholi districts. While the tactics and motivations of the LRA are unclear, there are several plausible explanations for this targeting, such as the substantial linguistic differences throughout Northern Uganda. Since the original LRA members primarily came from the Acholi districts, it was easier for the LRA to operate in these areas and to communicate with abducted individuals from these districts. Moreover, although the main bases for the LRA were in Southern Sudan, they had a number of smaller bases in the area including in Pader district (Fiala 2009). Over time, especially after

[21] Blattman and Annan (2010) use World Food Programme (WFP) food distribution lists from 2002 and a retrospective household roster to create household rosters for 1996, a time which predated 85 percent of local abductions. The roster was used to create a representative sample of young men from eight sub-counties within Kitgum and Pader districts.

2002, LRA attacks became more frequent in other parts of the country (Ssewanyana *et al.* 2007). This is partially due to the forced displacement within the Acholi districts by the government which deprived the LRA of potential targets for supplies and abductees, thereby forcing them to follow the migration.

V. Data

Several datasets are used in the analysis presented here. The Northern Uganda Survey (NUS) 2004 are geo-referenced community and household data representative for Northern Uganda. These contain detailed information on a variety of topics including individual and community exposure to violence and household consumption. After omitting communities and associated households with recorded coordinates outside of Uganda and household without food consumption or abnormally high holdings of land[22], the final NUS sample contains 230 communities and 2,300 associated households.

While the NUS contains information on livestock holdings, there is no information on cropping decisions. The 2002 Census for Uganda contains an agricultural module on livestock holdings at the time of question and on crops grown during the January-June, 2002, period (the last growing season prior to the Census). In addition to being the most recent census, it was also collected during the conflict and provides a variety of information on the 24.2 million individuals in Uganda. Consequently, rather than relying on representative data (such as the NUS), it is possible to directly observe crop and livestock portfolios for the full population.

[22] Households who report more than 200 acres of land are omitted. The overall sample for all of rural Northern Uganda has mean holdings of 3.7 acres with a standard deviation of 5.4 acres.

The Census contains data on 920,958 households in rural areas of Northern Uganda. The final sample used in the analysis contains only 690,836 households (75.0% of the overall rural population). This difference arises for three reasons. First, the empirical strategy relies on linking the census data with a geo-referenced map. The only parish level map of Northern Uganda is from 2006 but a variety of new parishes were established between 2002 and 2006. One of these new parishes could not be matched, resulting in the loss of its 41,002 households (5.2 percent). Second, while the agricultural module was administered to each household, 139,299 households (15.1 percent) could not be matched with the agricultural module. The pattern associated with the matching does not suggest that this is systematically related to exposure to conflict or to cropping or livestock patterns. Rather, this primarily occurs due to incorrect coding of identifiers such as parishes with districts. Although households that cannot be matched have a slightly higher incidence of exposure to conflict at the parish level (45.6 versus 41.0 percent), their mean conflict risk is slightly lower (38.0 versus 38.8 percent). Third, a further 49,891 households are omitted due to missing information from the community survey (5.4 percent).

These data are supplemented by the Armed Conflict Location and Event Data (ACLED) for Uganda (Raleigh and Hegre 2005). The ACLED data are drawn from a variety of sources including press accounts, books, and humanitarian worker accounts. The data are disaggregated by event type, year, participants, and geographical coordinates. This paper only uses the events that are violent, include the LRA, and occurred in 2004 or earlier. Additionally, since the precision of the geographical coordinates varies, I only include those that are precise to the village or sub-region location and exclude those which are only recorded at the regional level. The ACLED data are used to supplement the data on the geo-spatial variation of LRA attacks from 1997 until 2003.

The geo-spatial environmental data has been generously shared by Lang *et al.* (2010). Further information can be found in that paper. These include parish level measures of the percent of the parish land in different land types and agro-ecological zones. Tables 1 and 2 presents descriptive statistics for the data used.

VI. Methodology and Results

A. Estimating Risk

Since risk is not directly measured, measures of risk need to be estimated. Two different measures of risk are estimated: statistical (objective) and perceived (subjective) risk. Objective risk refers to the estimated probability of a community being attacked based on the observed geo-spatial variation of attacks across time. Subjective risk refers to the population's perceived risk of being attack. While related to objective risk, subjective risk may differ for a variety of reasons such as emotions, the information available, local conditions that cannot be observed in the data, or as the placement of violence evolves from its historical patterns (Lowenstein *et al.* 2001). For instance, the LRA might target particular areas or communities as revenge for perceived cooperation with the government or due to the defection of abductees from these regions. Slovic *et al*. (2002) suggest that subjective risk assessments are formed through interactions between analytical and experiential systems. Consequently, subjective risk is combination of objective risk and of individual feelings, memories and associations.

Since individuals make decisions based on their subjective risk assessments, these are conceptually superior to statistical measures of risk, Subjective risk measures, however, are rarely available. While it is possible to construct these with NUS data, this is not possible with

the Census data. Rockmore (2011) demonstrates that while subjective risk measures are better, objective risk measures can lead to qualitatively similar results.

While it would be preferred to estimate risk at the individual or household level, there is not sufficient data to do so. Consequently, similar to the Rockmore (2011), risk is estimated at a more aggregate level. As noted previously, the ideology of the LRA to "purify" Northern Uganda resulted in an in-group (LRA members) and out-group (everyone) mentality which resulted in largely homogeneous risk within villages. For the NUS data, risk is estimated at the community level. Due to the limited availability of geographical coordinates in the Census data, risk in these data is only estimated at the parish level. Parishes are the next level of aggregation above communities and group several communities together.

Equation (1) creates measures of risk using the spatial and temporal variation of LRA attacks:

(1) $Indicator_i = f(\alpha + \beta Z_i + \varepsilon_i)$

Where f(·) is the logistic cumulative density function. For objective risk, the dependent variable, $Indicator_i$, is a binary measure of exposure to risk. For the NUS data, this variable is based on a question in the community questionnaire on whether community i was attacked by the LRA in 2004. This questionnaire was administered to a group of community leaders representing different segments of the community, including women. Insofar as LRA attacks were important events, it is unlikely that the leaders would be unaware of prior attacks. Additionally, since the questionnaire was administered by a statistical agency unconnected with relief work, there is little incentive to falsely report attacks.

For the Census data, the dependent variable is also drawn from the community questionnaire and refers to a question on where there were any incidents of rebel activity the community. As previously noted, due to the impossibility to identify the coordinates of the individual communities, these answers are aggregated to the parish level. Consequently, the dependent variable measures whether or not there were any incidents of rebel activity within any of the enumeration areas within parish i. The community questionnaire was administered to a group of local leaders including the local chairperson, the Secretary for Youth and the Secretary for Women Affairs. As with the NUS data, there is little reason to believe that the data are systematically incorrect.

While the "incidents of rebel activity" is potentially less precise than attacks by the LRA (as recorded in the NUS), this is the only information within the Census questionnaire. However, since the entire country is surveyed, the Census data on attacks provides a more precise view of the movement and placement of LRA than do the NUS data. The predicted value from equation (2) therefore represent the probability that the community (parish) is attacked (has rebel activity).

As noted earlier, subjective risk measures can be constructed from the NUS data. As with the statistical risk measure, the binary dependent variable is drawn from the community questionnaire. It refers to a question as to whether or not any section of the community found it hard to cultivate land due to insecurity in 2004. Therefore, the predicted value is the likelihood that any section of the community found it hard to cultivate land during the year. Since this refers to a subjective belief, it is possible that the community leaders may have been unaware of the activities of others within communities. However, since most respondents are directly involved with agriculture, it is likely that difficulties related to farming are shared and communicated

within communities. Moreover, while there are certainly differences in beliefs within communities, I arguably control for many of the most important factors which might determine the heterogeneity – previous exposure to violence, demographic structure of the household, female head of household – so that any remaining heterogeneity is likely small and random. Importantly, this is not a direct measure of the perception of subjective risk. Rather, finding it hard to cultivate the land is a result of this perception and thus represents an indirect measure of subjective conflict risk.

The spatial and temporal variation in LRA attacks in the NUS and ACLED data are used to create the independent variables, Z_i, for the NUS estimation. Specifically, I use the distance of community i from LRA attacks (excluding attack on community i) in each of the previous years for which there are data. Consequently, to estimate risk for 2004, the independent variables include the distance to the nearest LRA attack in 2003, the distance to the nearest attack in 2002, and so forth. The vector β represents the partial correlation between the dependent variable and the distances from historical attacks. α represents the level of risk for community i if its distance to attacks in previous years is uniformly 0. ε_i is an error term that is assumed to have mean 0. The resultant estimation is presented in table 3. Since only the predicted value of risk is used, the best indicator of the fit is the percent of observations correctly predicted. For both the measure of objective and subjective risk, over 80% of the data is correctly predicted.

Some of the analysis relies on the change of (objective) risk levels between 1999 and 2004. Since available information on the prior placement of violence differs for the two periods, I re-estimate the risk levels for 2004 using the same number of lags on the distance to violence in

previous years. The results are presented in table 4. Again, the relative fit of the risk measures is close to 80%.

For the Census data, instead of using lagged values, I use distance from current rebel activity in the past 12 months. In contrast to the NUS and ACLED data, the Census allows for a full map of rebel activity for the region. However, since the Census occurs over a period of time, when the current activity is used, the timing of attacks is unclear. Specifically, the specific question in the Census asks whether there was any rebel activity within the past 12 months. Since the Census occurred over a period of time, rebel activity in certain areas may have occurred after data was collected in other regions. Consequently, the spatially disaggregated risk parameters creating from the Census data cannot be interpreted in the same casual manner as those from the NUS data.

α denotes the level of conflict risk within a parish if the distance to attacks in each year is 0, that is the amount of risk in a community which is attacked in each year. β is the correlation between this distance and rebel activity within the community. ε_i is an error term that is assumed to have mean 0. The results are presented in table 5. Despite the low number of explanatory variables, there is a relatively strong fit as 69% of the data is predicted correctly.

The change in the placement of violence and in the estimated level of risk in 1999 and 2004 can be seen in table 6. Even at the regional level, there is substantial variation in the incidence of violence. Overall, there are increases in the incidence in 4 of 5 regions. This reflects the response of the LRA to Ugandan government's Operation "Iron Fist", which attacked the LRA's bases in South Sudan. The LRA responded by increasing both the intensity of attacks as well as the regional scope of their attacks. In the data, this is reflected by the increase of violence in the

Acholi districts and the shift of attacks east and south (and away from the West Nile region in the North West). The estimated risk levels evolve in similar fashion with the exception of the Teso region which shows declining risk between the two points in time due to the initial high estimated risk in 1999.

Since the Census data is comprehensive for Northern Uganda, it is possible to examine the distribution of the statistical risk of attacks. In particular, a decomposition of the estimated statistical risk shows that roughly 75 percent of the variation is across the 198 sub-counties as opposed to within them. This strongly supports the assertion that LRA attacks are not random at the geographical level.

B. Estimating Livelihood Responses

As noted earlier, the observed changes to consumption in response to changing levels of risk can either come from behavioral responses from households or from broader general equilibrium effects. I first examine behavioral responses, starting with changes to the extensive margins, specifically the correlation between change in risk levels and the reported principle sources of income across time.

Extensive Margin: Sources of Income and Labor Force Status

One potentially important response to conflict risk is a shift in household income sources. That is a change in livelihoods. This shift may be voluntary as households seek to minimize exposure or forced as assets or infrastructure which underpin certain income sources become unavailable or less effective. The effect of conflict risk on the principle reported sources of income is identified by comparing changes in the main sources of income between household in the communities

which experience the greatest changes in estimated objective risk levels between 1999 and 2004. By comparing changes in income sources across time with locations, it is possible to eliminate the effects of any time invariant location-specific effects. Moreover, since the households are in communities which have essentially identical levels of estimated risk in 1999[23], their livelihoods should have responded in a similar fashion the conflict risk at the baseline. By comparing changes in levels of an outcome (the percent of households reporting a particular principle source of income[24]) across periods in similar communities, this approach resembles a difference-in-difference methodology.

Specifically, comparisons are made between the households with the greatest increase and decrease in risk. These households are grouped according to the distribution in the change of estimated risk between 1999 and 2004. Table 7 presents the results for the 1st and 5th quintile where the households in 1st quintile have the greatest decrease in risk between 1999 and 2004.[25] Since the choice of groups is arbitrary, the results for the 1st and 4th quartile are presented in Appendix 1. These results are qualitatively similar.

This analysis relies only on the non-IDP NUS sample due to the substantial difference in income sources in IDP camps and the great increase of IDP camps during this period. Moreover, the strong expenditure effects in the second chapter persist (and even increase) in the non-IDP population. The number of internally displaced individuals greatly increased during this period, particularly in late 2002 after Operation "Iron Fist" with reported increases of 100,000 internally

[23] As shown in table 7, the risk levels of the groups differ at the 25% level and the levels of risk are within 0.014 points of each other.

[24] The data does not record the amount of income from each source. Rather, it notes the principle self-reported source of income so it is not possible to examine change in the relative contributions of differences sources.

[25] As the groups grow smaller, there are tradeoffs as the absolute difference in risk levels between the first and last group grows but sample sizes decrease. Due to these reasons, significant results in the quintiles are perhaps more indicative than in the quartiles.

displaced individuals in 7 months in 2002 (NRC 2004). Within IDP camps, since there was limited access to land and income generating opportunities, the population became increasingly dependent on food aid (Allen and Schomerus 2006). The percent of households that report that "other transfer (food aid, other aid)" was the main sources of income increased from 4.3 to 19.8% for households who were in IDP camps in 2004 as compared to a constant 0.3% in non-IDP households. Consequently, when the IDP camp population is included, there appears to be a strong change in income sources due to risk.

As can be seen at the top of table 7, despite almost identical levels of estimated risk in 1999, the groups (1^{st} and 5^{th} quintiles) have significantly different levels of risk by 2004. In 1999, there are some differences in terms of principle sources of income. Wage employment is higher in the 5^{th} quintile, primarily driven by higher permanent employment levels. There is also evidence of lower self-employment within these same groups.

Comparing changes in the shares of employment between 1999 and 2004, only permanent employment is consistently (weakly) significant. With the quartiles (in appendix 1), there is also some evidence that the share of temporary employment increases faster in the groups whose risk increases the most. While these results are not causal, they suggest that the principle sources of income are only weakly linked with significant changes in estimated risk levels. Moreover, unlike Fernández *et al.* (2011), there is a little evidence of a shift from the agricultural to the non-agricultural sectors. The inability to measure the relative contributions of sections may mask this shift, however. Additionally, differences in the violence associated with the different conflicts might explain the lack of shift in Northern Uganda. Since abductions were highly prevalent,

working in the non-agricultural sector would not lessen the likelihood. In fact, it may have the opposite effect as areas with large groups of people of people may be more attractive targets.

These changes in employment are examined in table 8 which shows the employment status of non-disabled adults (aged 14-64).[26] The results for both the full and non-IDP camp population are displayed in table 8 while those for quartiles are included in appendix 2. Increases in risk are correlated with increased work as employees and a slightly larger decrease in unpaid family labor. The inclusion of the IDP population does not qualitatively change the results apart from the statistical significance of unemployed individuals. Similarly, limiting the sample to individuals aged 21-64 (not shown) lowers the portion of individuals in school and slightly increases the magnitude of the differences.

The discussions in the literature on the effects of conflict suggest the possibility of strong gender differences. This is examined in table 9, which restricts the sample to those aged 18-64 to limit the potential effects of schooling. The labor force participation of women does not appear strongly respond to the risk of violence. The magnitude of significant differences is quite small. When the quartile groups are used, there is a significant decrease in family workers. In the non-IDP quartile sample, there is a significant increase in the women who work in the high risk sample which almost matches the significant decrease in female students. In contrast, the effects of risk are pronounced for men. These results largely match the pattern in table 8 (the combined sample) with larger observed effects.

Interestingly, the share of employers in table 8 and 9 is extremely low and apparently does not noticeably shift with increases in risk. Since the share of employees increased, particularly for

[26] Since risk is estimated at the community level and since the number of households per community varies, the groups (quartiles and quintiles) are slightly imbalanced.

men, this implies that either the size of businesses increases with conflict or that other businesses, such as NGOs, are more prevalent in high-risk areas and that these absorb/hire away labor. In general, the shift away from unpaid family labor to becoming employees might be expected to result in higher income and therefore higher consumption levels. This contrasts with the observed lower consumption per capita in the second chapter as conflict risk rises. One possibility is that the increased number of non-family labor decreased wages. Additionally, the departure of unpaid family labor should decrease the productivity of assets, particularly land since is an integral part of the Northern Ugandan economy.

Extensive Margin: Livestock and Crop Holdings

In both 1999 and 2004, agriculture was the primary source of income for at least 75% of the sample. Consequently, it is the main sectors in which responses to conflict-risk might occur. While households face certain geographical and agro-meteorological constraints, these changes are likely to occur within their livestock and crop portfolios. As noted earlier, the limited available literature is consistent with shifts in the portfolio composition. The detailed agricultural module in the Census contains information on both livestock holdings and crop choices.

First, the number of each major livestock type is estimated using a series of tobit models

$$(2)\ Livestock_{ijk} = \alpha + \beta_1 \widehat{Risk}_j + \beta_2 \widehat{Risk}_j^2 + \theta Violence_j + \delta X_{ij} + \gamma_k + \varepsilon_{ijk}$$

where the livestock holding of household i, in parish j and sub-county k are presumed to be correlated with: (1) α: an intercept; (2) Risk: as estimated earlier using equation (2) and which enters with both linear and quadratic terms; (3) Violence: any LRA activity within the parish; (4)

X: a vector of controls for household characteristics (demographic profile[27], proportion of literate adults, and the gender, age, literacy, marital status and education of the head of the household), whether or not the household also produces crops, household assets[28], community characteristics[29], and parish level agro-ecological measures[30]; and (5) γ_k: sub-county fixed effects. The sub-county is the geographical level immediately above the parish and adds 198 additional fixed effects that control for a variety of unobserved sub-county invariant factors.

Importantly, IDP camps tended to be concentrated in the Acholi districts. While IDP camp status is not observed within the Census data, the sub-county fixed effects reduce the potential impact of this potentially important omitted variable. Additionally, the fixed effects also address any regional differences in livestock holding patterns and preferences (such as between Karamoja and the rest of Northern Uganda). Atypically large holdings of livestock are also omitted[31]. The error term, ε_{ijk}, is assumed to be mean zero and normally distributed.

The model does not permit the estimated effect of risk, β, to be interpreted as having a causal effect on livestock holdings. As noted earlier, this is because the risk estimates from the Census data are estimated using data from current attacks and therefore the timing surveys relative to attacks is uncertain. Despite this, the literature review on the effects of conflict risk along with

[27] Household demographics are disaggregated by gender and by the total number of individuals aged 0-5, 6-16, 17-50 and 51 and older in each household.
[28] The binary asset variables measure ownership of land, house, motor vehicle, motorcycle, bicycle, and mobile phone.
[29] Binary variables include those for a human disease epidemic, the presence of micro-finance institutions and for the presence of all-weather road, and for the presence of seasonal roads in the enumeration areas.
[30] The agro-ecological controls include measures for the percent of the parish area with shrub or tree leaf, herbaceous, coniferous plantation, woodland, bushland, grassland, or wetland cover. These also include the percent of land in humid, sub-humid, semi-humid or transition agro-ecological zones.
[31] A conservative measure of outliers is used; an outlier is any observation that is more than 6 standard deviations away from the mean of individuals who have positive holdings. If the sample were normally distributed, there should not be a single household that is 6 standard deviations from the mean (even in a sample with over 500,000 observations), much less than the mean of positive holdings.

the literature on the placement of attacks in Northern Uganda suggests that these results may be stronger than mere correlation. In particular, since the LRA tended to attack whichever village they encountered, shifts in household livestock holdings should not have impacted risk levels (especially at the parish level).

The results for the primary livestock in Northern Uganda are presented in table 10. As can be seen, livestock holdings are relatively prevalent with roughly one in two households owning goats and poultry. Ownership of sheep or cattle is less prevalent (10 and 20 percent ownership, respectively) while pigs are the least widely owned type of livestock. In each of the tobit estimations, there is a strong quadratic relationship between risk and the amount of livestock owned suggesting that the intensity of responses to risk decreases as risk increases.

Interestingly, livestock that need to be grazed showed the largest implied[32] declines due to conflict risk. Moreover, poultry, which can be exclusively raised within a compound or village showed the lowest relative decline. These results strongly match the non-quantitative literature on how household livestock portfolios respond to conflict risk. The large implied increases in pig holdings are also consistent with the particular context in Northern Uganda as both the LRA and the Karamajong, a neighboring ethnic group which frequently raided livestock, are not interested in pigs. The overall effect, however, may be limited due to the relatively low amount of households reporting any pig holdings.

[32] The average effect of risk is created by multiplying the coefficients for the risk terms, β_j, with the averages for linear and squared risk within the sample. The implied effect is the average effect of risk divided by the average non-zero holdings. That is, the implied effect of livestock j = $\frac{\beta_j * mean\ Risk}{mean\ holdings\ for\ households\ with\ level\ of\ livestock\ j>0}$ This is a more conservative estimate than when the mean holdings of livestock j are used. Since certain livestock, such as pigs, are kept by a relatively small amount of households, the mean holdings are substantially smaller than the mean positive holdings. The implied effect is the average effect divided by the average positive holdings.

Overall, the results suggest that the conflict risk is correlated with a strong decrease in the wealth held in livestock. While the census does not contain information on the prices of livestock nor on household income/consumption, this information is available in the NUS data. Using the median 2004 prices[33], at the mean risk levels, the changes in livestock decreased the average value of livestock by roughly 260,746 shillings ($150), which represents roughly 65% of the average value of livestock holdings and 25.5% of the mean annual consumption. Within the livestock portfolio, there is a shift from large grazing animals, such as cattle, towards smaller livestock which can be maintained with villages or compounds. In particular, the relative importance of pigs in the livestock portfolio increases greatly.

These estimates may somewhat overestimate direct household responses to the risk of violence for two reasons. First, the Census data does not contain information on prior attacks on households or communities. Insofar as previous attacks are correlated with the current placement of violence, the estimated parameter may reflect both factors. This potential concern, however, is mitigated by the fact that most communities and, especially, households never directly experience. Consequently, this concern only affects a fraction of the sample. Second, as previous mentioned, the government forced households in certain areas to relocate to IDP camps. Presumably, the forced relocations were located in areas which were likely to be attacked. In order to avoid panic sales, households in these areas might anticipate the relocation and decrease their livestock herds and shift towards livestock that fit better in an IDP camp context. Again, this potential effect is largely mitigated as these forced relocations were primarily in the Acholi districts and should be reflected in the sub-country fixed effects.

[33] Since the price data are imprecise and contain clear outliers, the price data were purged of prices which were more than six standard deviations above the non-zero prices mean for that particular livestock. The median value of this adjusted price distribution is then used.

Since these potential effects of these confounding factors are largely mitigated, the magnitude of the results strongly suggests that households decreased livestock holdings. The data are not sufficiently detailed to examine what happens to the proceeds from the livestock sales. Since Rockmore (2011) finds that increased conflict-risk leads to lower consumption levels, these proceeds do not appear to be consumed. While it cannot be verified, households presumably use the proceeds to either self-insure against destruction from attacks or to assist in voluntary migration following such attacks.

While livestock are important, it is not the primarily source of income for most households as many own little or no livestock. Consequently, the choice of crops provides another way to mitigate conflict risk within agriculture. For households with livestock, the size or the composition of livestock portfolios might also influence cropping decisions due to the need for draught power, manure or means to sell crop output. In contrast to the information on livestock, the total production of crops is not in the Census data. Therefore, cropping patterns are estimated using a series of probit models.[34] These models largely match model (3) except that the control variable for the household producing crops is switched with a variable for the household owning any livestock.

Table 11 shows the effects of the estimation. As compared to the previous examination of livestock, this estimation will "underestimate" the effects of risk. Since the probit examines the probability that a household grows a particular crop, it does not capture shifts in the intensive margins of production which leave crop choice unchanged. Despite this, there appear to be strong effects of risk on the two most prevalent crops, cassava and beans. The decrease in

[34] The probits are not estimated using a system of equations due to the size of the data. With over 670,000 households, the system would have over 4 million observations and over 200 independent variables. Computationally, this would require considerable time and computing power for limited gains in standard errors.

cassava cropping likely reflects several factors. For instance, cassava cropping typically relies on draught oxen (FAO 2005). Not only have these generally decreased in Northern Uganda due to looting, but the earlier analysis suggests further decreases in the available oxen due to conflict-risk. Additionally, despite its ability to well in marginal and stressed environment, its yields crucially depend on weeding with delays leading to yield reductions of over 90 percent (FAO 2005). Insecurity may reduce the ability of households to weed their cassava plots. Insecurity has also hindered the ability of households to sell their production and to receive crucial farm extension services since it is vulnerable to pests.

Similarly, conflict has likely also made bean production less attractive. Bean production is very labor intensive due to the need to clear the bushes and tall grasses endemic to Northern Uganda as well as labor intensive to harvest and to winnow (Fit Uganda Ltd. 2007). Additionally, the conflict may have limited the availability high yielding grains.

Since the production data in unavailable for crops, the results are difficult to interpret. In general, there appears to be a strong response in cropping patterns due to conflict. These do not appear to match the low-risk, low-return strategy suggested by the literature. Rather, the changes appear to be driven by the particular characteristics of crops, as opposed to their inherent riskiness. For the two crops with the greatest decreases, I hypothesize that this more reflective of the considerable manpower and oxen needed to farm these. More detailed data, including on household composition, however, are needed to verify this. Similarly, groundnuts, the crop with the third largest decline, are an important cash crop whose value to households substantially declines as markets become inaccessible due to insecurity.

In contrast to the primary sources of income and the labor force status, the livestock and crop portfolios appear to strongly respond to conflict risk. The evidence from the analysis of livestock strongly match prior expectations as overall holdings decreased and as the composition of livestock shifted from large grazing animals to smaller animals that can be kept within villages. Additionally, pigs were the only category of livestock whose holdings increased in response to conflict risk thereby underlining the importance of the varying risk associated with specific livestock types. In contrast, while the crop choice also responded greatly to conflict risk, the pattern did not match prior expectations of a shift towards to low-risk low-return crops. Rather, households appear to choose crops based on their characteristics, particularly the requirement labor and oxen for production.

Intensive Margin: Returns and Risk

One factor that could explain these shifts in portfolios would be if returns to assets depended on the levels of conflict risk. These changes may reflect general equilibrium effects, such as changing prices, or other factors such as the intensity of use. Changes in returns would also explain the lower consumption per capita observed in the second chapter as risk levels increased. The earlier review of literature suggests that this could occur during conflicts for a variety of reasons. Yields of crops could decrease due to premature harvesting or decreased fertilizer use, while livestock may be culled prematurely. Additionally, prices for assets may change dramatically as evidence by Verpooten's (2009) finding that the price of livestock declined by 50 percent during the genocide in Rwanda. More broadly, shifting employment patterns might also impact the returns to assets such as labor or human capital.

A modified quadratic function is used to investigate the relationship between assets, conflict risk and consumption per capita in the NUS sample.

$$(3)\ \widetilde{Consumption}_{lm} = \alpha + \sum_{i=1}^{N} \beta_i \tilde{a}_i + \sum_{i=1}^{N}\sum_{j=1}^{N} \beta_{ij} \tilde{a}_{il}\tilde{a}_{jl} + \widetilde{\widetilde{Risk}}_m\left(\gamma_m + \sum_{i=1}^{N} \pi_i \tilde{a}_i + \sum_{i=1}^{N}\sum_{j=1}^{N} \theta_{ij} \tilde{a}_i \tilde{a}_j\right) + \tau_{im}\tilde{X}_{lm} + \varepsilon_{lm}$$

where the data is centered at the data mean so that this specification represents an exact second-order approximation at the sample mean. So $\tilde{a_i} = a_i - (\sum_{i=1}^{N} a_i)/N$. Consumption is the log of per capita household consumption for household l in district m. α is the intercept term. a is a vector of productive assets. Assets are measured along several dimensions: livestock (number of oxen and cattle, of sheep and goats, of chicken, and of pigs), land (acres of land owned), and human capital (proportion of literate household member aged 10 or older).

The coefficient on the 2nd term, β_i, represents the correlation between assets and consumption at the sample mean and can be interpreted as the mean returns to asset i at the sample mean. The 3rd term contains the square and cross term which allow both for non-linear returns to asset i but also for its returns to depend both on its level and that of asset j.

The interaction terms between the estimated conflict risk (linear and squared terms) and the assets allow the returns to assets to change in response to the level of estimated risk. Moreover, by estimating the effect of risk through assets, π and θ, as well as by itself, γ, it is possible to separate some of the channels in which risk affects consumption. In particular, by controlling for many of the assets, γ, may be interpreted as reflecting many of the broader general equilibrium effects (although some of these may also be reflected in the prices of assets which results in changes in wealth levels). Specifically, γ, represents the marginal effect of estimated risk (from

mean risk levels) while π captures the joint effect of marginal changes in estimated risk and in asset levels as these change from their sample means.

The vector of control variables, X, reflects other factors that might influence consumption levels. Two different specifications are used. The first uses the same list of control variables as the second chapter.[35] The second specification supplements this list with several additional variables that might influence the returns to particular assets. The base specification contains controls for prior abductions, the demographic composition of the household, the gender of the head of household, whether the household had migrated due to insecurity (in 2004 or since 1992), the education of the head of the household, residence in an IDP camp, the presence of a major source of employment within 10 kilometers of the center of the community, the number of disabled within the household, and binary variables for the ownership of, respectively, a boat, motor vehicle, motorcycle, bicycle, and generator. Additionally district fixed effects are included and errors are clustered at the community level.

The second specification adds variables for the number of household members in school, and binary variables for the presence within the community of markets selling agricultural inputs, agricultural produce, or non-agricultural produce. This specification also includes the number of irrigated fields owned by the household and binary variables for the presence within 5 kilometers of the center of the community of a World Food Programme office or other NGO food distribution center, of NGOs assisting displaced people and former abductees or combatants or internally displaced people/camp. These factors may affect the returns of many of the assets examined.

[35] The list is not exactly the same as the Rockmore (2011) as he aggregates livestock into tropical livestock units (TLU) and uses this measure as a control variable. Livestock are included individually in the vector of assets and therefore do not enter as TLU.

Several broad patterns emerge from the estimation of equation (4).[36] Table 12 presents the marginal returns for assets at the sample mean when there is no risk ($\frac{\partial C}{\partial a_i}$|risk=0). Most assets have positive returns at the sample mean, implying that increases in household holdings above the mean levels would increase consumption. The returns to education are particularly high. These findings are consistent both with underinvestment by households due to credit constraints (per capita consumption in the sample is $0.30 per day) and with households avoiding assets that can be looted (with the exception of human capital).

The effects of risk are explored in table 13. Interestingly, effect of risk (at the mean level) completely disappears. It is only significantly different from 0 in two of the specifications and its magnitude is so small that it has no practical significance. In combination with the earlier results on portfolios, this suggests that almost all of the results reported in the second chapter are behavioral responses to risk; the general equilibrium effects are practically non-existent. That is, the losses associated with conflict risk – which represent the majority of all household level conflict losses – are driven by household portfolios allocations. The economic insignificant magnitude of the risk coefficient demonstrates that other unmeasured pathways, including general equilibrium effects, do not account for any of the significant losses associated with conflict.

As noted earlier, the shift in portfolios may be a response to risk induced change in returns to assets. As shown in the lower half of table 13, this is not case as the returns to assets at the sample mean ($\frac{\partial C}{\partial a_i \partial \text{Risk}}$) are generally not significant. The only exceptions are sheep/goats and literacy which are weakly significant in some of the specifications. Notably, these exceptions do

[36] The full results are presented in Appendix 3.

not occur when the conceptually superior (subjective) measure is used. Consequently, responses in asset levels do not appear to be due to changes in rates of return induced by conflict risk.

The earlier analysis of cropping portfolios was not able to examine production levels. The returns to land, however, should incorporate changes to production levels and yields as described by the literature. The insignificance of the coefficient for the interaction between conflict risk and land, however, appears at odds with the conflict-risk leading to lowered yields. One possible explanation is that conflict prevents households from using all their land. In that case, land ownership might not fully capture the above mentioned effects.

Overall, the analysis suggests that shifts to asset levels are one of the primarily paths by which conflict-risk decreases consumption. This is reinforced by both the general insignificance of the estimated π coefficients and the small magnitude of the effect of risk at the sample mean (despite significant γ coefficients).

VII. Discussion

Although conflict risk clearly affects household decisions, our empirical understanding has been limited; current analyses have focused on specific responses and therefore do not allow for a comprehensive view of responses and potential tradeoffs. Moreover, the inability to separate the effects of the insecurity from that of violence has made it impossible to quantify the different pathways from conflict to lower post-conflict outcomes. Using unique data, including potentially the largest dataset on conflict (~690,000), this paper has investigated different potential pathways in which households might adjust their livelihoods choices, livestock and crop portfolios, and/or experiences, and the returns to assets.

Insecurity has a very strong effect on the livelihoods of rural households in Northern Uganda. Reflecting the limited options for income diversification in rural Northern Uganda, households do not change livelihoods even in response to vary large change in the insecurity. That is, farmers remain farmers. Similarly, while there are changes to labor market behavior, these changes appear to be more limited. This likely reflects the general lack of alternate employment opportunities. While there was no effect on female labor, men shifted from unpaid family work to wage employment. Insofar as wage employment is typically associated with higher income and less variation in income, this finding runs counter to previous research linking conflict with lower consumption levels.

While responses to insecurity did not appear on the extensive margins, the results suggest important changes on the intensive margins. Within the dominant source of rural livelihoods, agriculture, there are substantial shifts in the composition of portfolios. These shifts only partially support the widely held belief that household shift away from profitable but risky (in terms of exposure to violence) activities towards less risk, low return activities. Within livestock portfolios, there is strong shift away from large, grazing livestock, despite the positive marginal returns, to smaller livestock which can be kept within compounds. Moreover, the overall value of livestock herds, which are typically targeted during conflicts, declined by roughly two thirds.

In contrast to the clear shift towards low-risk low-return activities in livestock portfolios, this is not as evident in crop portfolios. Insecurity clearly affected the choice of which crops to cultivate, however, these appeared to labor and draught intensive crops. This suggests a potentially important interaction between the risk reduction in the composition of livestock herds and the choice of crops even in areas where livestock are not the primary source of income. More

detailed data would permit this to be verified. More broadly, the results suggest insecurity may affect dietary diversity and overall nutrition by changing the composition of crops. Since local food markets may cease functioning during conflicts, this may have potentially important effects especially on the long run human capital of adolescents.

The large decreases in the size and value of livestock herds should result in large proceeds for households. Since the value of livestock portfolio declines by roughly one of fourth of annual mean consumption, this is an important unanswered question that cannot be examined with the data used here. While multiple possibilities exist, it is possible that household conserve the income to insure themselves against potential attacks and to have capital in case of forced migration due to insecurity or the government. At the same time, the saving levels may be higher than desired as the insecurity likely reduces the opportunities for households to productively invest; many peace-time opportunities may not be available while others only payoff over prolonged periods of time making them very risky during periods of conflict. Consequently, insecurity may lead households to decrease investment in a productive activity, livestock, without providing opportunities to reinvest the funds.

Returning to Rockmore's (2011) analysis of the relative contribution of insecurity and exposure of conflict to household losses, I find that the economic effect of insecurity disappears once portfolio choice is included in the estimation. Combined with the lack of effect of risk measures on productive assets (with the exception of human capital), this suggests that the majority of the changes in livelihoods occur at the intensive as opposed to extensive margins and that any general equilibrium effects are muted.

Table 1: Description of data from NUS and ACLED

	Mean	Min	Max
Estimated objective risk	0.29	0.00	0.97
Estimated objective risk, squared	0.21	0.00	0.94
Estimated objective risk*female head of household	0.09	0.00	0.97
Estimated objective risk 1999	0.25	0.00	0.71
Estimated objective risk 2004 using same model as the 1999	0.28	0.00	0.95
Estimated subjective risk	0.26	0.00	0.97
Estimated subjective risk, squared	0.14	0.00	0.94
Expenditure, ln(per capita annualized household expenditure)	0.08	0.00	0.97
Log of per capita consumption (shillings)	12.10	8.66	15.61
Total number of oxen or cattle	1.40	0.00	200.00
Total number of sheep or goat	2.56	0.00	100.00
Total number of poultry	3.47	0.00	75.00
Total number of pigs	0.22	0.00	15.00
Binary variable for ownership of a hoe (0=no, 1=yes)	0.93	0.00	1.00
Binary variable for ownership of a plough (0=no, 1=yes)	0.12	0.00	1.00
Female head of household	0.31	0.00	1.00
Number of household members in school	1.59	0.00	12.00
Number of disabled individuals in household	0.28	0.00	5.00
Proportion of household members literate aged 10 or older	0.51	0.00	1.00
Presence of market which sells agricultural inputs with LC1 (0=no, 1=yes)	0.05	0.00	1.00
Presence of market which sells agricultural produce with LC1 (0=no, 1=yes)	0.15	0.00	1.00
Presence of market which sells non-agriculture production with LC1 (0=no, 1=yes)	0.24	0.00	1.00
No schooling (0=no, 1=yes), head of household	0.10	0.00	1.00
Some schooling but did not finish primary (0=no, 1=yes), head of household	0.53	0.00	1.00
Finished primary (0=no, 1=yes), head of household	0.14	0.00	1.00
Some secondary schooling (0=no, 1=yes), head of household	0.17	0.00	1.00
Finished secondary (0=no, 1=yes), head of household	0.01	0.00	1.00
Specialized degree or diploma (0=no, 1=yes), head of household	0.05	0.00	1.00
Finished tertiary (0=no, 1=yes), head of household	0.00	0.00	1.00
No answer for schooling (0=no, 1=yes) , head of household	0.00	0.00	1.00
Presence of WFP or other food distribution within 5km of	0.11	0.00	1.00

LC1 center			
Presence of NGO assisting former combatants within 5km of LC1 center	0.07	0.00	1.00
Total land in the largest plots (acres)	3.70	0.00	88.00
Total amount of irrigated land (acres)	0.03	0.00	16.00
Number of individual aged 14-60 from household who are away	0.08	0.00	5.00
Presence of urban center or other major source of employment within 10 km (0=no, 1=yes)	0.14	0.00	1.00
Community, LRA attack in 2004 (0=no, 1=yes)	0.29	0.00	1.00
Community, cattle rustling in 2004 (0=no, 1=yes)	0.17	0.00	1.00
Community, LRA attack since 1992 (0=no, 1=yes)	0.45	0.00	1.00
Household attacked since 1992	0.43	0.00	1.00
Self-Employed, Agriculture (2004)	0.67	0.00	1.00
Self-Employed, Non-Agriculture (2004)	0.13	0.00	1.00
Wage Employment (2004)	0.12	0.00	1.00
of which Temporary (2004)	0.08	0.00	1.00
of which Permanent (2004)	0.04	0.00	1.00
Remittances (2004)	0.07	0.00	1.00
Other Sources (2004)	0.00	0.00	1.00
Self-Employed, Agriculture (1999)	0.73	0.00	1.00
Self-Employed, Non-Agriculture (1999)	0.09	0.00	1.00
Wage Employment (1999)	0.07	0.00	1.00
of which Temporary (1999)	0.03	0.00	1.00
of which Permanent (1999)	0.04	0.00	1.00
Remittances (1999)	0.02	0.00	1.00
Other Sources (1999)	0.00	0.00	1.00
Work	0.98	0.00	1.00
of which Employer	0.00	0.00	1.00
of which Self-Employed	0.87	0.00	1.00
of which Employee	0.11	0.00	1.00
of which Family Worker (unpaid)	0.01	0.00	1.00
Unemployed	0.00	0.00	1.00
Student	0.00	0.00	1.00
Domestic Duties/Homemaker	0.01	0.00	1.00
Other	0.00	0.00	1.00
Any abduction since 1992 (0=no, 1=yes)	0.00	0.00	1.00
Any abduction in 2004 (0=no, 1=yes)	0.06	0.00	1.00
Female head of household	2.61	0.00	12.00

Total number in household younger than 14	2.28	0.00	9.00
Total number in household between 14-60	0.20	0.00	3.00
Total number in household older than 60	0.06	0.00	3.00
Total number in household older than 60	0.02	0.00	4.00
Head of household migrated due to insecurity, 2004 (0=no, 1=yes)\	0.02	0.00	1.00
Head of household migrate due to insecurity, ever (0=no, 1=yes)	0.22	0.00	1.00
Distance to nearest attack 1997, ACLED	0.83	0.02	2.43
Distance to nearest attack 1998, ACLED	0.45	0.00	1.36
Distance to nearest attack 1999, ACLED	0.86	0.01	2.22
Distance to nearest attack 2000, ACLED	0.92	0.00	2.49
Distance to nearest attack 2001, ACLED	0.69	0.01	2.11
Distance to nearest attack 2002, ACLED	0.37	0.00	1.60
Distance to nearest attack 2003, ACLED	0.21	0.00	0.95
Distance to nearest attack 2004, NUS	0.34	0.00	1.09
Distance to nearest attack 1999, NUS	0.28	0.00	1.25
Distance to nearest attack 1992. NUS	0.31	0.00	1.37

Table 2: Description of data from the 2002 Ugandan Census

	Mean	Min	Max
Was there any rebel activity in the parish in the past 12 months?	0.40	0.00	1.00
Estimated Risk (Logit)	0.39	0.00	0.75
Estimated Risk*Estimated Risk (Logit)	0.19	0.00	0.57
Any livestock in the household (0=no, 1=yes)	0.65	0.00	1.00
Any crops in the household (0=no, 1=yes)	0.82	0.00	1.00
Goats, owned (total)	2.37	0.00	133.00
Sheep, owned (total)	0.94	0.00	196.00
Pigs, owned (total)	0.11	0.00	29.00
Cattle, owned (total)	1.64	0.00	190.00
Chicken, owned (total)	3.27	0.00	104.00
Cassava, grown in last season (Jan-Jun 2002)	0.33	0.00	1.00
Sweetpeas, grown in last season (Jan-Jun 2002)	0.18	0.00	1.00
Groundnuts, grown in last season (Jan-Jun 2002)	0.08	0.00	1.00
Sorghum, grown in last season (Jan-Jun 2002)	0.17	0.00	1.00
Maize, grown in last season (Jan-Jun 2002)	0.22	0.00	1.00
Beans, grown in last season (Jan-Jun 2002)	0.31	0.00	1.00
Millet, grown in last season (Jan-Jun 2002)	0.15	0.00	1.00
Sesame, grown in last season (Jan-Jun 2002)	0.17	0.00	1.00
Male household members, aged 0-5	0.61	0.00	10.00
Male household members, aged 6-16	0.88	0.00	15.00
Male household members, aged 17-50	1.00	0.00	48.00
Male household members, aged 51 or older	0.19	0.00	10.00
Female household members, aged 0-5	0.61	0.00	10.00
Female household members, aged 6-16	0.84	0.00	18.00
Female household members, aged 17-50	1.12	0.00	19.00
Female household members, aged 51 or older	0.18	0.00	11.00
Proportion of household members aged 10 or older who are literate	0.36	0.00	1.00
Head of the household male, (0=no, 1=yes)	0.78	0.00	1.00
Head of the household married, (0=no, 1=yes)	0.84	0.00	1.00
Head of the household, no education	0.33	0.00	1.00

Head of the household, some education	0.38	0.00	1.00
Head of the Household, completed P7	0.16	0.00	1.00
Head of the Household, completed J3	0.09	0.00	1.00
Head of the Household, completed S6	0.01	0.00	1.00
Head of the Household, completed a certificate	0.02	0.00	1.00
Head of the Household, completed diploma training	0.01	0.00	1.00
Head of the Household, completed a degree	0.00	0.00	1.00
Is the head of the household literate? (0=no, 1=yes)	0.60	0.00	1.00
Age of the head of the household	41.16	10.00	95.00
Own a house, (0=no, 1=yes)	0.95	0.00	1.00
Own land, , (0=no, 1=yes)	0.04	0.00	1.00
Own at least one motorvehicle, (0=no, 1=yes)	0.00	0.00	1.00
Own at least one motorcycle, (0=no, 1=yes)	0.01	0.00	1.00
Own at least one bicycle, (0=no, 1=yes)	0.40	0.00	1.00
One at least one mobile phone, (0=no, 1=yes)	0.01	0.00	1.00
Did the LC1 experience any cattle rustling in the past 12 months? (0=no, 1=yes)	0.15	0.00	1.00
Did the LC1 experience any incidence of rebel activity in the past 12 months? (0=no, 1=yes)	0.27	0.00	1.00
Did the LC1 experience any drought in the past 12 months? (0=no, 1=yes)	0.76	0.00	1.00
Is there a market place for crops in the LC1? (0=no, 1=yes)	0.21	0.00	1.00
Is there a market place for animals/poultry in the LC1? (0=no, 1=yes)	0.05	0.00	1.00
Did the LC1 experience any major disease affecting crops in the past 12 months? (0=no, 1=yes)	0.90	0.00	1.00
Did the LC1 experience any major disease affecting livestock in the past 12 months? (0=no, 1=yes)	0.95	0.00	1.00
Did the LC1 experience any human epidemic in the past 12 months? (0=no, 1=yes)	0.86	0.00	1.00
Do you have any formal micro-credit institutions in the LC1> (0=no, 1=yes)	0.10	0.00	1.00
Is there an all weather road in or bordering the LC1? (0=no, 1=yes)	0.42	0.00	1.00
Is there an a seasonal road in or bordering the LC1? (0=no, 1=yes)	0.56	0.00	1.00
Distance of the parish to an urban center	21.30	0.40	68.90
Fraction of the parish which is populated	0.99	0.24	1.00
Fraction of the parish covered by water	0.01	0.00	0.76
Fraction of the parish covered by trees/shrub	0.00	0.00	0.27
Fraction of the parish covered by herbaceous	0.36	0.00	1.00
Fraction of the parish in the humid agro-ecological zone	0.01	0.00	1.00

Fraction of the parish in the sub-humid agro-ecological zone	0.13	0.00	1.00
Fraction of the parish in the semi-humid agro-ecological zone	0.84	0.00	1.00
Fraction of the parish in the transition agro-ecological zone	0.01	0.00	1.00
Fraction of the parish covered by coniferous plantation	0.00	0.00	0.30
Fraction of the parish covered by woodland	0.15	0.00	1.00
Fraction of the parish covered by bushland	0.05	0.00	1.00
Fraction of the parish covered by grassland	0.13	0.00	1.00
Fraction of the parish with wetland cover	0.00	0.00	0.36

Table 3: Logit Estimating Objective and Subjective Risk of Community Attacks

	Obj	**Subj**
Distance to nearest attack 1992. NUS	0.41	-0.8
	[3.14]	[2.04]
Distance to nearest attack 1999, NUS	0.49	2.56
	[5.42]	[2.92]
Distance to nearest attack 2004, NUS	-6.16**	-1.54
	[2.92]	[2.61]
Distance to nearest attack 1997, ACLED	1.98	8.00***
	[2.02]	[1.81]
Distance to nearest attack 1998, ACLED	-0.56	-1.92
	[2.11]	[1.80]
Distance to nearest attack 1999, ACLED	-0.16	-8.14***
	[1.99]	[2.19]
Distance to nearest attack 2000, ACLED	-1.97	0.73
	[1.56]	[1.65]
Distance to nearest attack 2001, ACLED	-0.5	1.19
	[2.51]	[2.06]
Distance to nearest attack 2002, ACLED	-2.54	-5.04***
	[2.60]	[1.81]
Distance to nearest attack 2003, ACLED	-15.52***	-1.56
	[4.18]	[1.84]
Constant	3.22***	0.43
	[1.16]	[0.50]
Observations	353	353
Pseudo R^2	0.59	0.35
Percent of LRA attacks in 2004 correctly classified	89.2%	80.2%

Robust standard errors in brackets, community weights used

*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 4: Logit Estimating Objective and Subjective Risk of Community Attacks for 2004, 1999

	Obj 1999	Obj 2004
Distance to nearest attack t-1, ACLED	-3.27***	-20.40***
	[0.64]	[4.04]
Distance to nearest attack t-2, ACLED	-1.29***	-6.52***
	[0.39]	[2.11]
Constant	0.96**	2.95***
	[0.39]	[0.62]
Observations	353	353
Pseudo R^2	0.22	0.53
Percent of LRA attacks in 2004 correctly classified	78.7%	87.8%

Robust standard errors in brackets, community weights used

*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 5: Logit Estimating Objective Risk for the Census data

	Attack
Distance to nearest activity	-0.18***
	[0.02]
Constant	1.12***
	[0.13]
Observations	1174
Pseudo R^2	0.14
Percent of LRA attacks in 2004 correctly classified	69.0%

Robust standard errors in brackets, community weights used

*, **, *** statistically significant at the 10%, 5%, 1% levels respectively

Table 6: Placement of LRA Attacks and Estimated Risk in 1999 and 2004

	% Communities Attacked			Estimated Obj. Risk		
Region	1999	2004	Change	1999	2004	Change
Acholi	84.4%	98.6%	14.2%	60.1%	80.4%	20.3%
Karamoja	5.3%	10.5%	5.3%	6.0%	11.0%	5.0%
Lango	37.8%	48.8%	11.0%	46.0%	51.5%	5.5%
Teso	7.7%	14.2%	6.5%	14.5%	11.1%	-3.4%
West Nile	9.9%	2.8%	-7.0%	11.1%	8.9%	-2.2%

Table 7: Changes in Sources of Income Between Households in non-IDP Communities with the Greatest Increase and Decrease in Estimated Risk Between 1999 and 2004

Group Type: **Quintile**

	1st	5th	Difference
Change in risk levels between 1999 and 2004	-0.27	0.33	0.60***
Average risk levels in 1999	0.36	0.35	0.00
Sample size	512	486	

	% reporting each source in 1999		
Sources	1st	5th	Difference
Self-Employed, Agriculture	0.83	0.81	-0.02
Self-Employed, Non-Agriculture	0.10	0.05	-0.05**
Wage Employment	0.05	0.12	0.07***
of which Temporary	0.03	0.03	0.00
of which Permanent	0.02	0.10	0.08***
Remittances	0.01	0.01	0.00
Other Sources	0.00	0.00	0.00

	Difference between 1999 and 2004 in % reporting each source		
Sources	1st	5th	Difference
Self-Employed, Agriculture	-0.06	-0.07	-0.01
Self-Employed, Non-Agriculture	0.01	0.02	0.01
Wage Employment	0.02	0.02	0.00
of which Temporary	0.02	0.04	0.02
of which Permanent	0.01	-0.01	-0.02*
Remittances	0.03	0.02	0.00
Other Sources	0.00	0.00	0.00

*,**,*** Significant at the 1, 5, 10% level, respectively

Table 8: Labor Force Status for Non-Disabled Adults (14-61) by Risk Group

Full Sample

	Quintile		
	1st	5th	Difference
Work	0.66	0.65	-0.02
of which Employer	0.00	0.00	0.00
of which Self-Employed	0.36	0.36	0.00
of which Employee	0.04	0.08	0.04***
of which Family Worker (unpaid)	0.26	0.20	-0.06***
Unemployed	0.00	0.01	0.01*
Student	0.26	0.25	-0.01
Domestic Duties/Homemaker	0.05	0.08	0.03
Other	0.02	0.01	-0.01
Sample Size	1,681	1,617	

Non-IDP Population

	Quintile		
	1st	5th	Difference
Work	0.66	0.67	0.00
of which Employer	0.00	0.00	0.00
of which Self-Employed	0.36	0.36	0.00
of which Employee	0.04	0.08	0.04***
of which Family Worker (unpaid)	0.26	0.22	-0.04*
Unemployed	0.00	0.00	0.00
Student	0.27	0.24	-0.03
Domestic Duties/Homemaker	0.04	0.07	0.03*
Other	0.02	0.02	-0.01
Sample Size	1,345	1,349	

*,**,*** Significant at the 1, 5, 10% level, respectively

Table 9: Labor Force Status for Non-Disabled Adults (18-61) by Risk Group and Gender

Full Sample

	Female			Male		
	1st	5th	Difference	1st	5th	Difference
Work	0.85	0.86	0.01	0.90	0.90	-0.01
of which Employer	0.004	0.00	-0.004*	0.002	0.01	0.01
of which Self-Employed	0.35	0.39	0.04	0.71	0.67	-0.04
of which Employee	0.05	0.07	0.02	0.07	0.16	0.09***
of which Family Worker (unpaid)	0.45	0.39	-0.05	0.12	0.05	-0.07**
Unemployed	0.001	0.001	0.0002	0.005	0.01	0.01*
Student	0.04	0.02	-0.02	0.05	0.07	0.02
Domestic Duties/Homemaker	0.09	0.12	0.03	0.01	0.02	0.01
Other	0.02	0.004	-0.01*	0.02	0.004	-0.02
Sample Size	621	630		510	505	

Non-IDP Population

	Female			Male		
	1st	5th	Difference	1st	5th	Difference
Work	0.86	0.87	0.004	0.91	0.90	-0.01
of which Employer	0.005	0.002	-0.003	0.00	0.01	0.004
of which Self-Employed	0.36	0.39	0.03	0.72	0.65	-0.07
of which Employee	0.05	0.06	0.01	0.07	0.19	0.12***
of which Family Worker (unpaid)	0.45	0.41	-0.04	0.12	0.06	-0.06**
Unemployed	0.001	0.00	-0.001	0.001	0.01	0.01
Student	0.04	0.01	-0.03**	0.06	0.06	0.01
Domestic Duties/Homemaker	0.08	0.11	0.03	0.01	0.02	0.01
Other	0.02	0.01	0.00	0.03	0.01	-0.02
Sample Size	502	506		411	391	

*,**,*** Significant at the 1, 5, 10% level, respectively

Table 10: The Relationship Between Livestock Holdings and the Risk of Violence

	Goats	Sheep	Pigs	Cattle	Poultry
Coefficient on Estimated Risk-Linear Term	-5.14***	-12.27***	3.55***	-10.66***	-2.54***
	(0.42)	(1.13)	(0.53)	(0.90)	(0.36)
Coefficient on Estimated Risk-Quadratic Term	5.79***	13.0***	-3.27***	15.05***	2.53***
	(0.42)	(1.51)	(0.64)	(1.17)	(0.45)
R^2	0.05	0.13	0.10	0.11	0.04
Sample Size	690,615	690,658	690,764	690,514	690,714
Effect of Risk Evaluated at Sample Mean	-0.87	-2.24	0.74	-1.22	-0.49
Percent of Households with Positive Holdings	40.8%	10.9%	4.5%	20.0%	50.2%
Average Holdings for Households with Positive Holdings	5.8	8.6	2.4	8.2	6.5
Mean Effect as Percent of Average Positive Holdings	-14.9%	-26.1%	30.2%	-14.9%	-7.6%

*,**,*** Significant at the 1, 5, 10% level, respectively

Standard Errors in Parentheses

Table 11: The Relationship Between Crop Choice and the Risk of Violence

	Cassava	Sweetpea	Groundnuts	Sorghum	Maize	Beans	Millet	Sesame
Coef. on the Estimated Risk-Linear Term	0.72***	0.41***	0.08	0.23***	-0.14***	1.00***	-0.85***	-1.62***
	(0.06)	(0.07)	(0.08)	(0.07)	(0.06)	(0.06)	(0.07)	(0.07)
Coef. on the Estimated Risk-Quadratic Term	-0.97***	-0.49***	-0.43***	-0.27***	0.05	-1.39***	0.94***	1.62***
	(0.07)	(0.08)	(0.09)	(0.07)	(0.01)	(0.07)	(0.08)	(0.08)
R^2	0.18	0.18	0.14	0.30	0.16	0.28	0.18	0.20
Sample Size	673,870	689,737	689,737	689,737	690,836	689,737	689,737	672,694
Marginal Effect at Mean								
Estimated Risk-Linear Term	0.22***	0.09***	0.01	0.04***	-0.04***	0.25***	-0.16***	-0.33***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Estimated Risk-Quadratic Term	-0.29***	-0.10***	-0.06***	-0.05***	0.01	-0.35***	0.18***	0.33***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Overall Effect on Probability to Grow Crop	-7.4%	-1.6%	-4.6%	-0.7%	-2.4%	-9.7%	1.6%	0.1%
Percent of Sample Growing Crop	32.6%	17.9%	8.5%	17.3%	22.1%	30.1%	15.2%	16.9%

*,**,*** Significant at the 1, 5, 10% level, respectively

Standard Errors in Parentheses

Table 12: Marginal Returns to Assets at Mean Levels

	Objective Risk		Subjective Risk	
	Specification		Specification	
	1	2	1	2
Cattle/Oxen	0.02***	0.02***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)
Sheep/Goats	0.00	0.00	0.01	0.01
	(0.01)	(0.01)	(0.00)	(0.00)
Poultry	0.01***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Pigs	0.03	0.03	0.03	0.03
	(0.03)	(0.02)	(0.03)	(0.03)
Total land owned (acres)	0.02***	0.02***	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)
Proportion Literate, aged 10+	0.20***	0.17***	0.21***	0.19***
	(0.04)	(0.04)	(0.04)	(0.04)

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 13: Average and Marginal Effects of Risk at Mean Levels

	Objective Risk		Subjective Risk	
	Specification		Specification	
Effect of Risk	1	2	1	2
Average Effect (with no assets)	-0.00**	-0.26	-0.00**	0.00
	(0.00)	(0.35)	(0.00)	(0.00)
Marginal Effect (with no assets)	0.16	0.19	-0.83***	-0.78***
	(0.25)	(0.25)	(0.33)	(0.33)
Marginal Effect of Risk on Asset				
Cattle/Oxen	0.11	0.10	-0.07	-0.05
	(0.11)	(0.11)	(0.09)	(0.10)
Sheep/Goats	0.15*	0.13	-0.01	-0.02
	(0.08)	(0.09)	(0.06)	(0.06)
Poultry	0.00	0.00	-0.01	-0.01
	(0.05)	(0.05)	(0.05)	(0.05)
Pigs	-0.12	-0.07	-0.02	0.09
	(0.29)	(0.30)	(0.31)	(0.31)
Total land owned (acres)	0.00	0.00	0.06	0.05
	(0.05)	(0.05)	(0.07)	(0.07)
Proportion Literate, aged 10+	-0.86*	-0.78*	-0.35	-0.36
	(0.46)	(0.45)	(0.51)	(0.50)

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix 1: Changes in Sources of Income Between Households in non-IDP Communities with the Greatest Increase and Decrease in Estimated Risk Between 1999 and 2004

Group Type: **Quartile**

	1st	4th	Difference
Change in risk	-0.24	0.28	0.52***
Average risk in 1999	0.33	0.32	-0.01
Sample size	852	926	

	% reporting each source in 1999		
Sources	1st	4th	Difference
Self-Employed, Agriculture	0.84	0.81	-0.03
Self-Employed, Non-Agriculture	0.09	0.07	-0.03
Wage Employment	0.05	0.11	0.06***
of which Temporary	0.03	0.03	0.00
of which Permanent	0.02	0.08	0.06***
Remittances	0.02	0.01	0.00
Other Sources	0.00	0.00	0.00

	Difference between 1999 and 2004 in % reporting each source		
Sources	1st	4th	Difference
Self-Employed, Agriculture	-0.05	-0.08	-0.03
Self-Employed, Non-Agriculture	0.00	0.02	0.02
Wage Employment	0.02	0.03	0.01
of which Temporary	0.02	0.04	0.03**
of which Permanent	0.01	-0.01	-0.01*
Remittances	0.02	0.02	0.00
Other Sources	0.00	0.00	0.00

*,**,*** Significant at the 1, 5, 10% level, respectively

Appendix 2: Labor Force Status for Non-Disabled Adults (14-61) by Risk Group

Full Sample

	Quartile		
	1st	4th	Difference
Work	0.66	0.63	-0.03
of which Employer	0.00	0.00	0.00
of which Self-Employed	0.36	0.36	0.00
of which Employee	0.04	0.08	0.04***
of which Family Worker (unpaid)	0.26	0.20	-0.06***
Unemployed	0.00	0.01	0.01***
Student	0.26	0.26	0.00
Domestic Duties/Homemaker	0.06	0.08	0.02
Other	0.02	0.01	-0.01
Sample Size	2,070	2,025	

Non-IDP Population

	Quartile		
	1st	4th	Difference
Work	0.66	0.67	0.01
of which Employer	0.00	0.00	0.00
of which Self-Employed	0.36	0.36	0.00
of which Employee	0.04	0.08	0.04***
of which Family Worker (unpaid)	0.26	0.23	-0.03*
Unemployed	0.00	0.00	0.00
Student	0.26	0.24	-0.02
Domestic Duties/Homemaker	0.06	0.07	0.01
Other	0.02	0.02	-0.01
Sample Size	1,686	1,683	

*,**,*** Significant at the 1, 5, 10% level, respectively

Appendix 3: Returns to Assets and the Effect of Risk on These Returns

		Objective Risk		Subjective Risk	
		Specification		Specification	
β_i		1	2	1	2
	Cattle/Oxen	0.02***	0.02***	0.03***	0.03***
		(0.01)	(0.01)	(0.01)	(0.01)
	Sheep/Goats	0.00	0.00	0.01	0.01
		(0.01)	(0.01)	(0.00)	(0.00)
	Poultry	0.01***	0.01***	0.01**	0.01**
		(0.00)	(0.00)	(0.00)	(0.00)
	Pigs	0.03	0.03	0.03	0.03
		(0.03)	(0.02)	(0.03)	(0.03)
	Total land owned (acres)	0.02***	0.02***	0.02***	0.02***
		(0.01)	(0.01)	(0.01)	(0.01)
	Proportion Literate, aged 10+	0.20***	0.17***	0.21***	0.19***
β_{ij}		(0.04)	(0.04)	(0.04)	(0.04)
	Cattle*Cattle	-0.00*	-0.00*	-0.00**	-0.00**
		(0.00)	(0.00)	(0.00)	(0.00)
	Sheep*Sheep	0.00**	0.00**	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Poultry*Poultry	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Pigs*Pigs	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Land*Land	-0.00***	-0.00***	-0.00**	-0.00*
		(0.00)	(0.00)	(0.00)	(0.00)
	Literate*Literate	0.08	0.10	0.04	0.06
		(0.10)	(0.10)	(0.10)	(0.10)
	Cattle*Sheep	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Cattle*Pigs	0.01	0.01	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)
	Cattle*Poultry	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Sheep*Pigs	-0.01	-0.01	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Sheep*Poultry	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Pigs*Poultry	0.00	0.00	-0.01**	-0.01**

		(0.00)	(0.00)	(0.00)	(0.00)
	Cattle*Land	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Land*Pigs	0.00	0.00	0.00	0.00
		(0.01)	(0.01)	(0.00)	(0.00)
	Land*Poultry	-0.00**	-0.00**	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Land*Sheep	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)
	Cattle*Literate	0.00	0.00	0.01	0.01
		(0.02)	(0.02)	(0.01)	(0.01)
	Literacy*Pigs	0.02	0.03	0.08**	0.08**
		(0.03)	(0.03)	(0.03)	(0.03)
	Literacy*Poultry	0.01	0.01	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)
	Literate*sheep	0.01	0.01	0.02*	0.02
		(0.01)	(0.01)	(0.01)	(0.01)
	Literate*Land	0.00	0.00	0.00	0.00
π_i		(0.01)	(0.01)	(0.01)	(0.01)
	Cattle*Risk	0.11	0.10	-0.07	-0.05
		(0.11)	(0.11)	(0.09)	(0.09)
	Sheep*Risk	0.15*	0.12	-0.01	-0.02
		(0.08)	(0.08)	(0.06)	(0.06)
	Poultry*Risk	0.00	0.00	-0.01	-0.01
		(0.05)	(0.05)	(0.05)	(0.05)
	Pigs*Risk	-0.12	-0.07	-0.02	0.09
		(0.29)	(0.29)	(0.31)	(0.31)
	Land*Risk	0.00	0.00	0.06	0.05
		(0.05)	(0.05)	(0.07)	(0.07)
	Literate*Risk	-0.86*	-0.78*	-0.35	-0.36
θ_{ij}		(0.46)	(0.45)	(0.51)	(0.50)
	Land*Land*Risk	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.01)	(0.01)
	Literate*Literate*Risk	-1.02	-0.98	0.28	0.19
		(1.18)	(1.19)	(1.33)	(1.33)
	Cattle*Cattle*Risk	-0.02**	-0.02**	0.00	0.00
		(0.01)	(0.01)	(0.00)	(0.00)
	Sheep*Sheep*Risk	-0.02***	-0.01***	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)

Poultry*Poultry*Risk	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Pigs*Pigs*Risk	0.05	0.03	0.01	-0.01
	(0.05)	(0.05)	(0.04)	(0.04)
Cattle*Sheep*Risk	0.01	0.01	0.00	0.00
	(0.01)	(0.01)	(0.00)	(0.00)
Cattle*Pigs*Risk	0.07	0.06	0.02	0.01
	(0.09)	(0.08)	(0.08)	(0.07)
Cattle*Poultry*Risk	-0.01	-0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Sheep*Pigs*Risk	0.03	0.03	0.02	0.02
	(0.03)	(0.04)	(0.04)	(0.04)
Sheep*Poultry*Risk	-0.01	-0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Pigs*Poultry*Risk	0.01	0.01	0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.03)
Cattle*Land*Risk	0.02	0.02	0.01	0.01
	(0.02)	(0.02)	(0.01)	(0.01)
Land*Pigs*Risk	0.06	0.06	0.04	0.05
	(0.08)	(0.08)	(0.06)	(0.06)
Land*Poultry*Risk	-0.01	-0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Land*Sheep*Risk	0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Cattle*Literate*Risk	-0.04	-0.03	-0.07	-0.03
	(0.20)	(0.19)	(0.20)	(0.19)
Literate*Pigs*Risk	0.06	0.16	-0.66	-0.69
	(0.38)	(0.38)	(0.46)	(0.45)
Literate*Poultry*Risk	0.07	0.07	-0.06	-0.04
	(0.10)	(0.10)	(0.09)	(0.09)
Literate*Sheep*Risk	-0.04	-0.01	-0.13	-0.14
	(0.14)	(0.15)	(0.11)	(0.11)
Literate*Land*Risk	0.19*	0.21**	-0.20	-0.25*
	(0.11)	(0.10)	(0.15)	(0.14)
Cattle*Risk*Risk	-0.18	-0.16	0.11	0.08
	(0.13)	(0.13)	(0.13)	(0.13)
Sheep*Risk*Risk	-0.20*	-0.17	0.02	0.05
	(0.10)	(0.10)	(0.08)	(0.08)
Poultry*Risk*Risk	0.02	0.03	0.03	0.03

	(0.06)	(0.06)	(0.05)	(0.05)
Pigs*Risk*Risk	0.14	0.11	0.03	-0.05
	(0.32)	(0.32)	(0.40)	(0.40)
Land*Risk*Risk	0.00	0.00	-0.07	-0.07
	(0.06)	(0.06)	(0.08)	(0.08)
Literate*Risk*Risk	0.56	0.47	0.17	0.21
	(0.55)	(0.54)	(0.63)	(0.60)
Land*Land*Risk*Risk	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.01)	(0.01)
Literate*Literate*Risk*Risk	1.74	1.76	0.22	0.44
	(1.35)	(1.35)	(1.62)	(1.63)
Cattle*Cattle*Risk*Risk	0.03**	0.02**	-0.01	-0.01
	(0.01)	(0.01)	(0.00)	(0.00)
Sheep*Sheep*Risk*Risk	0.03***	0.02***	0.00	0.00
	(0.01)	(0.01)	(0.00)	(0.00)
Poultry*Poultry*Risk*Risk	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Pigs*Pigs*Risk*Risk	-0.06	-0.05	-0.04	-0.02
	(0.05)	(0.05)	(0.05)	(0.05)
Cattle*Sheep*Risk*Risk	-0.01	-0.01	0.01	0.01
	(0.02)	(0.02)	(0.01)	(0.01)
Cattle*Pigs**Risk*Risk	-0.08	-0.08	0.00	0.02
	(0.12)	(0.12)	(0.18)	(0.17)
Cattle*Poultry*Risk*Risk	0.01	0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Sheep*Pigs*Risk*Risk	-0.03	-0.03	0.03	0.03
	(0.04)	(0.04)	(0.05)	(0.05)
Sheep*Poultry*Risk*Risk	0.01	0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Pigs*Poultry*Risk*Risk	-0.02	-0.03	-0.05	-0.06
	(0.04)	(0.04)	(0.05)	(0.05)
Cattle*Land*Risk*Risk	-0.01	-0.01	0.00	0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Land*Pigs*Risk*Risk	-0.06	-0.06	-0.04	-0.04
	(0.09)	(0.09)	(0.06)	(0.06)
Land*Poultry*Risk*Risk	0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Land*Sheep*Risk*Risk	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)

	Cattle*Literate*Risk*Risk	0.02	0.01	0.10	0.05
		(0.25)	(0.24)	(0.25)	(0.23)
	Literate*Pigs*Risk*Risk	0.00	-0.11	1.05*	1.04*
		(0.41)	(0.41)	(0.55)	(0.55)
	Literate*Poultry*Risk*Risk	-0.13	-0.13	0.07	0.05
		(0.12)	(0.11)	(0.11)	(0.11)
	Literate*Sheep*Risk*Risk	0.06	0.02	0.14	0.15
		(0.18)	(0.18)	(0.17)	(0.17)
	Literate*Land*Risk*Risk	-0.26**	-0.30***	0.19	0.23
γ_m		(0.11)	(0.11)	(0.15)	(0.15)
	Risk	0.16	0.19	-0.83**	-0.78**
		(0.25)	(0.25)	(0.33)	(0.32)
	Risk*Risk	-0.40	-0.41	0.99**	0.93**
		(0.28)	(0.28)	(0.39)	(0.38)
	Observations	3467	3437	3467	3437
	R-squared	0.42	0.43	0.42	0.42

Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

District-level fixed effects

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CHAPTER 4

INSECURITY IN A PASTORAL SETTING: CONSEQUENCES AND DYNAMICS

Co-authored by Christopher B. Barrett

I. Introduction

Negative impacts from conflict and other forms of physical insecurity have been reported along a number of dimensions including consumption (Ibáñez and Moya, 2010; Rockmore 2011), education (Akresh and de Walque 2011; Shemyakina 2011) and nutrition/health (Akresh *et al.* 2011, forthcoming; Minoiu and Shemyakina forthcoming). While some of these impacts arise from direct exposure to conflict, it is becoming increasingly clear that much of these negative impacts result from costly precautionary responses by households to mitigate conflict risk (Justino 2009; Rockmore 2011). Costly responses to insecurity (i.e., the risk of violence) have been reported in labor markets (Fernández *et al.* 2011; Menon and Rodgers 2011) and the choice of crops and livestock (Finnström 2003; Bundervoet 2007; Rockmore 2012; Vlassenroot 2008). Rockmore (2011) estimated that insecurity causes at least half of the aggregate consumption costs from conflict in northern Uganda as even though the personal costs of suffering violence exceed those of conflict risk, far more people suffer from risk than directly experience violence.

The importance of household responses to insecurity suggests an important, but to date overlooked, link with the broader literatures on the role of subjective expectations in guiding behavior and determining economic outcomes (Manski 2004) and on costly responses to risk (Rosenzweig and Binswanger 1993; Carter 1997; Dercon 2008). Differences in subjective expectations may explain why observationally similar households respond very differently when

confronted with uncertainty. Despite this importance, our empirical knowledge about the effects of insecurity remains extremely limited. The main limitation has been the absence of household-level measures of subjective perceptions of insecurity, which has prevented researchers from directly identifying responses to perceived insecurity risk. Rather, empirical results have been interpreted based on qualitative priors of household responses to insecurity. For instance, numerous authors find increases in the production of low-risk low-return crops during conflicts which they attribute to insecurity (*inter alia* Finnström 2003; Bundervoet 2007; McKay and Loveridge 2005; Vlassenroot 2008). While these choices are consistent with households minimizing potential exposure to violence, the actual perceived insecurity is never directly measured. Even when measures of conflict risk are constructed (Rockmore 2011; 2012), these do not directly measure individual-level subjective risk but rather are community-specific estimates that rely on the spatio-temporal variation in the realization of violence and assume homogeneity of exposure and perception within communities.

Using a unique ten-period quarterly panel of household subjective perceptions of insecurity, this paper focuses on three important and previously unstudied issues regarding conflict risk. First, we study the relative contribution of individual-level subjective expectations of insecurity on income. In doing so, we make multiple important innovations including separating the effects of current and prior expectations of insecurity on income. Since individuals make decisions based on their subjective expectations and since shifts in income generating activities and portfolios may be both time consuming and costly to change, current income levels may reflect both current beliefs as well as responses to perceptions during previous periods. Moreover, the effects of the risk of violence have been studied in isolation from other risks even though violence is just one of many (potentially correlated) risks to which households might respond. Consequently,

using similar data on households' subjective perceptions of a variety of other common risks, including those concerning health, weather and prices, we examine the robustness and relative income effects of insecurity risk. Furthermore, prior studies on the micro-economic costs of conflict have typically relied on cross-sectional data and therefore could only control for observed characteristics or use aggregate geographical fixed effects. The panel nature of these data allows us to control for unobserved time invariant individual characteristics that are likely correlated with outcomes and potentially also correlated with risk exposure or perceptions.

Second, the micro-conflict literature has not addressed the potential effects of seasonality on household responses to conflict. Since there is often strong seasonality in both income and insecurity, the effects of insecurity are likely to vary across time and, moreover, there could be some conflation of common seasonal patterns with a causal effect of conflict (or conflict risk) on income. The quarterly structure of data used roughly corresponds to the bimodal distribution of rainfall in the survey region, which influences herding patterns of livestock, the main asset that underlies most livelihoods in the region. But conflict also varies seasonally and in response to agro-meteorological conditions. We therefore allow for the effects of insecurity to vary based on the season in which it occurs.

Third, having established the importance of subjective perceptions of insecurity, we examine their evolution over time. In particular, we focus on the role of prior beliefs in determining current subjective perceptions. If subjective beliefs of conflict risk are both costly and persistent, economic recovery from episodes may be slow.

We find that the effect of the perceptions of insecurity can be masked both by using aggregate income and by constraining its effects to be constant across time. At first glance, there does not

appear to be a significant association between subjective perceptions of insecurity and aggregate income or with it components. However, when the effects of insecurity are allowed to vary across seasons, strong effects emerge in both aggregate income and in specific income components. Interestingly, insecurity is not uniformly associated with lower income. Looking at the evolution of perceptions across time, we find that while prior beliefs are significantly correlated with current perceptions of insecurity, their effect is relatively small in magnitude and decreases over time. Rather, households largely determine their beliefs anew each quarter, suggesting that perceptions may respond quickly post-violence and thus that any adverse effects of insecurity need not persist very long. In contrast to prior beliefs, agro-meteorological conditions play an important role with pasture quality – as reflected by remotely-sensed normalized differenced vegetation index (NDVI) measures – playing the largest role in explaining subjective expectations of insecurity. In addition to broadening the focus of the conflict literature away from just weather, this finding suggests that agro-meteorological models and remote sensing data may be useful in developing early warnings indicators for perceptions of insecurity in these regions.

The remainder of the paper is organized as follows. The context and data are presented in section II. Section III examines the effects of subjective expectations of insecurity on income and its components, as well the season-specific effects of these subjective perceptions. Section IV examines the evolution of perceptions across time while section V concludes.

II. Context and Data

The data are drawn from the southern Ethiopia sub-sample of the Pastoral Risk Management (PARIMA) project, which focused on 11 communities located within a single broad livestock

production and marketing region that spans the Kenyan and Ethiopia border (Barrett *et al.* 2008; Doss *et al.* 2008; McPeak *et al.* 2012). As described below, due to concerns about endogenous migration, we limit our analysis to the five communities in Ethiopia. The broader PARIMA region covers arid and semi-arid lands where extensive livestock grazing – pastoralism – remains the dominant livelihood. As a result, not only is household wealth largely concentrated in livestock but livestock also forms an integral part of local economies. Although some households have become sedentarized, many others herd livestock across large areas, seasonally or even more frequently, in search of water and pasture. Household members and livestock are often spread across base and satellite camps in order to provide pasture and water for the livestock.

The analysis uses quarterly data collected from households from March 2000 through June 2002. While households were randomly selected within communities, the communities were not randomly selected but rather were chosen to represent the relevant ethnic and geographic variation within the broader PARIMA region. Consequently, the analysis in the paper is only representative for the particular sample communities.

The survey communities were populated mainly by members of the Borana people, with the exception of Finchawa, which is just north of the Borena zone and populated by a mixture of Guji and Gabra Miigo peoples, both of which are historically and culturally related to the Borana (McPeak *et al.* 2012). The Borana communities relied primarily on pastoralism with little economic diversification. This is reflects in part the region's bimodal distribution of rainfall – a long rains season typically runs from March through June and a less reliable short rains season commonly begins in October and ends in December – and the arid-to-semi-arid climate, which limits the potential for crop cultivation, especially outside of lowland seasonal stream basins. This bimodal distribution of rainfall also results in long-range migration of herds in search of

dry-season grazing pasture. Finchawa, the non-Borana community, is at somewhat higher altitude, enjoys better rainfall, and as a result has more extensive cultivation and less extensive migration of livestock in its mixed crop-livestock system.

In addition to the natural attrition in samples from death or migration, the pastoral setting adds additional difficulties. Due to temporary migration, there are periods when a household could not be found and is therefore absent from the sample. Since household migration is potentially determined by perceptions of future risks, there is strong potential for endogenous sample attrition or interruption. In the Kenyan sample, only 93 of the 182 households (51%) were interviewed in all 10 periods.[37] This was not exclusively due to attrition as 159 households (87%) were interviewed at least 8 times. In contrast, 148 of 150 Ethiopian households were interviewed in all 10 periods (99%). Consequently, to avoid issues related to attrition bias and the potential of temporary migration due to perceptions, the analysis we report is limited to the Ethiopian households present in each period. Of the 148 households, 144 are used in the final analysis as 4 of the households did not provide information on the age of the head of the household, one of the key control variables as this reflects life cycle effects.

The PARIMA survey questionnaire collected both retrospective information about shocks in the previous three months as well as prospective information on perceived subjective risks over the coming three months. The quarterly structure of the sampling was chosen to roughly correspond to the above-mentioned bimodal distribution of rainfall. The information on perceptions was collected from the self-identified head of the household. In certain cases, such as when the head of the household was temporarily away herding animals at a distant location, the acting head of

[37] Looking at a more disaggregated level, none of the Kenyan communities had more than 70 percent of the households present in every period.

household was interviewed. Since it is not possible to identify this in the data, the perceptions are interpreted as those of the household, as opposed to head of household.

The quarterly household surveys recorded each respondent's forward-looking subjective perceptions for a variety of different prospective sources of risk. More specifically, heads of the sample households were asked which shocks they believed could affect their household in the coming three months, selecting from a list of 11 shocks commonly cited by people – developed in open-ended pre-testing in the area – or from an open-ended "other" option. The listed risks were lack of pasture for animals, insufficient water for animals, animal sickness or death, animal loss due to theft or raiding, physical insecurity and violent conflict, human sickness, no buyers for animals you wish to sell, low prices for animals you wish to sell, food shortages, high prices for things you buy, and crop failure. Since households were asked which shocks might affect their household, their answers presumably combine both their expectations regarding the probability of the shock and their beliefs regarding their ability to address various outcomes (Smith *et al.* 2001, Doss *et al.* 2008).

Although the elicited perceptions are prospective, they may also reflect some evolution of perceptions since the previous quarterly elicitation of subjective perceptions. That is, while perceptions are measured every three months, households continuously update their perceptions (and their resultant behaviors) throughout the period. Since we observe perceptions only at the beginning and the end of the quarter, changes in perceptions that took place during the period may be reflected in the perception declared at the end of the period. Consequently, it is important to recognize that household income in a quarter may be influenced by both the perceptions declared at the beginning of that quarter as well as by that part of the prospective perceptions that it declares at the end of the quarter, which surely reflect changes in perceptions that occurred

during the quarter and that may have affected behavior or outcome realizations during the quarter. Insofar as income generating activities cannot change instantaneously, we would expect that the prior perceptions should have relatively more effect. The difficulty of discrete observations of continuously-updated perceptions underscores an intrinsic identification problem inherent to this sort of empirical investigation. Prospective subjective concerns are almost surely influenced by current and recent conditions and behaviors. We therefore emphasize our inability to make any causal statements about the relationship between subjective expectations and income or behaviors; we can only describe suggestive statistical associations.

Corresponding information on the realization of prospective shocks is also recorded at the community level the subsequent quarter. Similar to the individual data, there are missing observations for the communities. While this was partially related to problems with enumerators not returning surveys or to difficulties in finding key informants, there were also problems with insecurity in Ethiopia.[38] Only 40 of the 50 potential quarterly community observations regarding raids are available. This problem is further addressed when it arises in the analysis.

The key dependent variable on which we focus is quarterly per capita income. Household income for the quarter is created by combining the income from trade and business, wages and salary, livestock sales and products, remittances (including food aid) and harvested crops from the quarter. Livestock sales and production, milk production, crop production, and food aid are valued using community quarter price averages. Milk production was estimated using household specific base and satellite camp average daily production. Quarterly average household income for the pooled sample is displayed in the first column of Table 1.[39] The sample is extremely poor

[38] Based on personal correspondence with the lead researchers involved in collecting the PARIMA data.
[39] The sample is only 1296 since the income data was not collected for the first period of the sample.

with per capita daily income of approximately US$0.10 per day. Livestock sales and production represent close to 80 percent of total income. Despite media reports regarding food aid, remittances (which include food aid) represent only approximately 10 percent of overall income.

In the pooled quarterly data, households perceived risks from a wide variety of shocks, with 10 of the 12 risks mentioned by at least half the sample and two shocks mentioned by 80 percent of the sample (Table 2). In particular, the households are relatively concerned with prices for purchased items and with food security. While insecurity and cattle theft/raiding are not among the most mentioned risks, they remain potentially quite important as they are both mentioned by roughly half of the households.

Violence and insecurity have been reported in this area since at least the colonial period with much of the violence surrounding livestock raiding, which served a variety of purposes: traditional (e.g., to secure bridewealth or demonstrate bravery), coping mechanism (e.g., to restock herds after droughts or disease outbreaks), or to avenge prior raids or perceived slights (Smith *et al.* 2001, McPeak *et al.* 2012). More recently, raiding in pastoralist settings has evolved due to the increased prevalence of automatic weapons and become increasingly commercial (Fleisher 2000). For instance, in the years preceding the data collection, there were very large incidents of cattle raiding with certain communities losing more than 70 percent of total livestock within the year (Smith *et al*. 2001).

McPeak *et al.* (2012) report that violence in the area varied greatly across time but that incidents of violence and insecurity occurred roughly every 4-6 months during the 2000 to 2006 period. Despite the presence of violence and the widespread concerns regarding conflict and raiding, Yirbecho *et al*. (2004) report that more than half of the overall PARIMA sample report never

experiencing conflict during the previous decade. Thus, for most households in the region, the effects, if any, of insecurity on their incomes and behaviors would be attributable to the risks they faced rather than to any direct injuries to people or property they suffered. Hence, the importance of exploring the relationship between subjective perceptions of insecurity risk and household incomes and behaviors.

Prior studies have suggested several patterns with raids and perceptions of insecurity. Violence appears more concentrated in (ethnic) border areas, particularly those between with hostile neighbors. In those areas, quite apart from the greater risk of violence, communities' ability to adjust herding patterns is partially limited since access to pastures and water is often governed by clan, sub-clan or family affiliations (Smith *et al*. 2000, 2001). In particular, the eastern and western borders of the survey region are particularly dangerous as they capture the ethnic frontiers between the Borena and the Somalis on the east and the Dassanach to the west. Poorer households appear more concerned by insecurity and cattle raids, perhaps due to their relatively higher concentration of wealth in livestock (Smith *et al*. 2001). The overall concentration of wealth in livestock also results in a strong correlation between perceptions of insecurity and livestock theft (0.61 in the PARIMA sample).

The flow and ebb of violence described by McPeak *et al.* (2012) is apparent as perceptions of violence and insecurity vary greatly during this period (Figure 1). The strong notable increase in perceptions during 2000 corresponds with the end of a major drought from late 1999 to 2000 which also significantly affected vegetation. The fluid nature of these subjective perceptions, particular after mid-2000, suggests significant intertemporal updating of subjects' prior beliefs, which we corroborate a bit more rigorously below. In addition to the temporal variation apparent in Figure 1, there is also considerably spatial variation within the sample (Table 3). Fear of

insecurity varies among communities, from relatively low levels in Finchawa, the northernmost and most economically diversified sample community, to nearly every respondent in Qorate, a heavily pastoral community near the Somali ethnic frontier. The inter-community pattern appears highly correlated with communities' pastoral nature, with more pastoral communities more fearful of insecurity and livestock theft.

We also control for the agro-meteorological conditions. A variety of weather related factors, such as rainfall (Miguel *et al.* 2004), temperature (Burke *et al.* 2009), El Nino/Southern Oscillation (ENSO) (Hsiang *et al.* 2011) and climate change (Gledistch 2012), have been linked to the incidence of conflict. The empirical literature, however, has primarily focused on rainfall since it is a key input to economic activity in rain-fed agricultural economies (as well as an available and plausibly exogenous instrumental variable). In the Horn of Africa, however, there are an estimated 20 million pastoralists whose livelihoods rely on livestock and pastures. While rainfall is an important input to pasture quality, it does not solely determine pasture conditions, which are jointly affected by stocking rates, soil conditions, etc. Consequently, pastoralist income may be determined less by rainfall than by pasture levels. For instance, in Northern Kenya, herd losses are better explained by measures of pasture quality, such as the normalized difference vegetation index (NDVI), than by rainfall (Chantarat *et al.* forthcoming).

The data for the normalized difference vegetation index (NDVI) and for rainfall are both drawn from the PARIMA data.[40] Both the rainfall and NDVI data are derived from satellite data and represent the value for the pixel at the center of each location. The rainfall variable reflects the

[40] As is further described in the associated codebook (Barrett et al. 2008), the NDVI data are drawn from the USGS ADDS-FEWS NDVIg (2000-2004) and USGS ADDS-FEWS NDVIrg (2000-2007) data series for NDVI (http://iridl.ldeo.columbia.edu/SOURCES/.USGS/.ADDS/.NDVI/) and the rainfall data from NOAA NCEP CPC FEWS Gridded Africa DAILY RFE (http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.FEWS/.Africa/.DAILY/.RFEv2/) .

total rainfall over the quarter, expressed in standard deviations from the quarter-specific average total rainfall for the quarter during the 2000 to 2004 period. NDVI measures the degree to which a pixel contains live green vegetation. The variable is used as a proxy for the available pasture for livestock. It measures the maximum NDVI from the quarter, in standard deviations, relative to the average maximum NDVI for the quarter during the 2000 to 2007 period. Current subjective perceptions are then matched with agro-meteorological conditions over the previous quarter. Table 4 shows the variation in rainfall and NDVI during the sample period, averaging the standard deviations across communities. Reflecting the bimodal distribution of rainfall, the 2^{nd} and 4^{th} quarters have the highest levels of rainfall. The end of the major 1999-2000 drought appears clearly in the data.

III. Perceptions of Insecurity and Income

Perceptions regarding insecurity may affect income through a variety of channels including household-level migration, the composition and size of livestock portfolios, the division of livestock and family members between the base camp and satellite camps, or even market prices for animals and animal products and other general equilibrium effects. Although many of these responses are observable in the data, others are not, such as changes in animal husbandry. Rather than focusing on trying to identify a particular pathway, household income provides a summary measure the aggregate net effect of risk on well-being, whether through changed behavior, changes in prices, or other pathways.

Income offers several advantages over consumption in these data. Insofar as households are able to smooth consumption through savings or inter- or intra-household transfers, consumption may understate the effects of risk. Moreover, in contrast to most surveys, in this setting income may

be easier to measure than consumption. Households were often divided geographically across multiple camps but the survey only interviewed those at the base camp. Average livestock production rates, however, are more easily obtained and are potentially less sensitive to recall bias than retrospective consumption measures. The managers of this survey expressly indicate greater confidence in the income aggregates than the consumption ones (Barrett *et al.* 2008).

We estimate the following model:

$$(1)\ Income_{ijt} = \sum_{k=1}^{K}\sum_{s=0}^{1}\beta_k RP_{ik,t-s} + \theta_i HH_{i,t-1} + \sum_{s=1}^{S}\varphi_s Shocks_{ijt} + \tau_l Agromet_{jt} + \sum_{n=1}^{4}\delta_n quarter_n + \sum_{k=2000}^{2002}\gamma_k year_k + \sum_{i=1}^{N}\gamma_i + \varepsilon$$

Where $Income_{ijt}$ measures the total income of household i in community j during the quarter ending at time t. To better understand losses associated with insecurity, we also estimate equation (1) using each of the six income components (trade and business earnings, livestock sales, livestock products, crops harvested, remittances, and wages and salary) as the dependent variable in place of total household income. Income is a function of several factors. $RP_{ik,t-s}$is a vector of the risk perceptions declared at both time t-1 for the past quarter and at time t for the coming quarter over K different risks. The perception measures are dichotomous (1=yes, 0=no), reflecting whether the household expressed concern about that specific risk.[41] We first consider the effect of perceptions of insecurity and theft in isolation from other perceptions (K=2) before introducing all the other elicited risk perceptions (K=12).

The household fixed effects, γ_i, account for unobservable time invariant characteristics that might determine income, such as skill or social connections. Since the heads of household do not

[41] In addition to this information, there is also information on the ordinal rankings of expressed risks. Since the concerns varies over both periods and respondents, it is difficult to incorporate the model without either imposing additional structure on the model or including dummy variables for the range of possibilities (e.g., ranked 2nd among 9 declared risks, ranked 3rd among 3 risks, etc.)

change during this period, this also includes the gender and education of the head of the household. The time varying household characteristics, $HH_{i,t-1}$, include the age and age squared of the head of the household to reflect potential changes in earnings due to lifecycle effects, and the number of household members (headcount), at time t-1, the beginning of the quarter in which the income is earned. We also include measures of aggregate livestock holdings (in tropical livestock units, TLU[42]) at the beginning of the period, in both linear and squared terms so as to allow for a non-linear effect of livestock holdings. These measures capture both much of the wealth of households as well as their relative exposure to insecurity and cattle theft.

The $Shocks_{ijt}$ vector includes binary variables reflecting exogenous events the household suffered during the quarter in which the income was earned: any deaths of household members, any deaths of a working age individual (16-64), or any theft of livestock from the household (1=yes, 0=no). We do not include community shocks because missing information on several of these variables would reduce the final sample by roughly 40 percent. If shocks are correlated with risks, when shocks are omitted, the coefficients for perceptions may capture both effects. Since we are able to include variables measuring insecurity, such as livestock thefts, this is primarily a concern for the other risk perceptions, which are only included as controls anyway.

The vector $Agromet_{jt}$ measures rainfall and pasture quality (NDVI) during the period in which the income is earned. Since the exact relationship between agro-meteorological conditions and income is unknown, we allow for a quadratic relation by including both linear and squared terms. These also control for certain weather-related community-level shocks. We also include quarter (seasonal) and year fixed effects.

[42] Tropical livestock units are means to aggregate livestock by their mean live weights. We use the standard weighting system of TLU= 1 cattle = 0.7 camels = 10 goats = 11 sheep.

The top half of Table 5 presents the results when only the current and lagged perceptions for insecurity and theft are included (K=2) while the bottom panel includes all the available risk perceptions (K=12).[43] The first column measures the effect of lagged perceptions on total income while the subsequent columns disaggregate this effect by examining the effects on each of the income components individually. The errors are clustered at the household level.

At first glance, subjective perceptions of the risk of both insecurity and theft do not affect (aggregate) income. Even when income is disaggregated into its components, perceptions of insecurity are never correlated with any of the income components. In contrast, fears of livestock theft are associated with significant increases of income from livestock products, equivalent to 13% of quarterly income. This may arise from an increase in the amount of slaughtered animals to prevent theft. Alternately, if the perceptions change herding patterns, it might allow greater time to milk animals. Additionally, when all the available risk perceptions are included, perceptions of livestock theft are also correlated with a slight decrease in incomes (1.4%) from remittances.

Comparing the top and bottom halves of Table 5, the inclusion of the subjective expectations of a broader range of risks has only a limited impact on the point estimates of the effects of insecurity and their significance levels. This suggests that, in this particular context, examining the effects of insecurity and of perceptions of cattle theft in isolation from other potential risks does not greatly distort the findings.

The results from Table 5 suggest that insecurity and fears of cattle theft have little if any effect of income. While the latter is associated with income changes, these are primarily positive and do

[43] The full results are presented in Appendix Table 2.

not appear to affect aggregate income, presumably due to an ability of household to substitute income from different income sources. Of course, households whose income is relatively more concentrated remittances may be particularly vulnerable. In general, however, these results seemingly contrast with the literature which suggests and find effects of insecurity – particularly in conflicts as opposed to pastoral communities in Ethiopia – as well as the general qualitative evidence on insecurity in the studied area (Dercon 2004; Justino 2009; Rockmore 2011; 2012).

In part, this may arise from the model specification. In equation (1), the effects of risk perceptions, β_k, are allowed to vary across years. Its effects, however, are constrained to be constant within a given year. That is, $\beta_k^{rainy\ season} = \beta_k^{dry\ season}$ within any given year. There are, however, a variety of reasons to believe that the effects of risk perceptions may vary intra-annually particularly as income generating opportunities likely vary greatly across seasons. In particular, the strong bimodal distribution of rainfall noted earlier regulates the economic opportunities, the associated returns, and the available diversification opportunities (Bailey *et al.*, 1999; Little *et al.*, 2001). Even within rainy seasons, there are strong differences in the amount of rainfall and its certainty between the long and short rains. In addition to the clear implications for cropping, climate (including rainfall) helps to determine livestock productivity. The impact of climate on the productivity increases in lower less stable rainfall zones, precisely the areas which rely the most on livestock (Bailey *et al.*, 1999). Moreover, prices for animal sales and animal products may be affected if supply and demand are related to seasons.

We explore this possibility by relaxing the constraint in equation (1) that the effects of perceptions are constant across time.

$$(2)\ Income_{ijt} = \sum_{k=1}^{K}\sum_{s=0}^{1}\beta_k RP_{ik,t-s} * quarter_n + \theta_i HH_{i,t-1} + \sum_{s=1}^{S}\varphi_s Shocks_{ijt} + \tau_l Agromet_{jt-1} + \sum_{n=1}^{4}\delta_n quarter_n + \sum_{k=2000}^{2002}\gamma_k year_k + \sum_{i=1}^{N}\gamma_i + \varepsilon$$

Equation (2) is identical to equation (1) with the exception of the interaction between the current and lagged perceptions, $RP_{ik,t-s}$, with the fixed effects for the quarter. The coefficient vector, β_k, of the interaction terms represents the marginal effect of perceptions within the risk quarter, thereby allowing for seasonality in the impact of such risk on earnings.

Table 6 presents the results for insecurity, the primary subjective perception of interest, when all the data for risk perceptions are used (K=12). The errors are clustered by household. For ease of comparison, the results from each of the regressions are presented horizontally. That is, the first row of results is drawn from a single estimation of equation (2) using total income as the dependent variable. Consequently, the vertical columns show the marginal effect of insecurity in each quarter across regressions. The top half of the table presents the results for current perceptions of insecurity while the bottom for the lagged perceptions. As shown in equation (2), both sets of interactions are included in each regression so that the first rows for current and lagged insecurity are from the same estimation.

As specified in equation (2), the quarters are from time t and the income is from the quarter ending at time t. Therefore, in the 4th column, the current perception is from the beginning of the 4th quarter, the lagged perception is from the beginning of the 3rd quarter and the income is earned between during the 3rd quarter.

Two things emerge from table 6. First, there exists a certain amount of heterogeneity in the effects of perceptions that was previously masked. Depending on the quarter, current perceptions of insecurity are weakly correlated with income from livestock sales and remittances, equivalent

to 22 and 10 percent of average quarterly income respectively when significant. While there is (limited) potential for reverse causality between perceptions at end of the quarter and income earned during the quarter, this is not possible for the perceptions at the beginning of the quarter (the lagged perception). Here again, there is evidence of seasonality in the effects of perceptions as lagged insecurity is correlated with aggregate income and income from remittances. Not only do the significance levels increase, but the size of the magnitudes as well with insecurity at the beginning of the 3rd quarter leading to a more than 50 percent change in average quarterly income over the quarter.

The second point which emerges is that perceptions of insecurity are not always significantly correlated with lower income. Whereas the literature has primarily linked insecurity with lower income, the results here are mixed. Current and lagged perceptions of insecurity are both linked with increases and decreases of income depending on the quarter of the perception and the income component. Most notably, the coefficient of lagged perceptions of insecurity on income during the 3rd quarter is not only positive but also significant at the 1.7 percent level.

The positive coefficients on insecurity might arise for several reasons. One possibility is that households increase consumption (and hence income) during periods of insecurity in order to mitigate potential losses. Another possibility is that this increased income compensates for decreased income in the prior period. In particular, the coefficient for current perceptions of insecurity in column (3) is barely insignificant (significant at the 10.7 percent level). In that case, the (current) perceived insecurity would lead to substantial decreased income in the 2nd quarter (-431 birr) which would be partially compensated (+341 birr) in the subsequent 3rd quarter (as it becomes a lagged perception).

In part, the identification of the heterogeneous effects of perceptions across quarters is complicated by the dichotomous nature of the measure of insecurity. The inability to capture changes in the magnitude of risk perceptions reduces the variation in the data, making it more difficult to identify the effects of insecurity (and other perceptions) particularly with the individual level fixed effects and the relatively short panel (8 periods). Despite this difficulty, there is still evidence of seasonality. Although the coefficients for the interactions terms are frequently statistically different in pairwise statistical tests, they are typically not significantly different in joint statistical tests of the interaction terms between insecurity and quarter.

IV. The Dynamics of Subjective Perceptions of Insecurity Risk

The previous analyses suggest that subjective perceptions of insecurity affect, often negatively, income and its various components. Consequently, it is important to better understand the persistence of subjective insecurity risk across time because if households update such perceptions quickly, then the economic costs of insecurity can be limited when violence subsides, while if insecurity risk perceptions persist, economic recovery post-violence might be quite slow.

We examine the dynamics of insecurity perceptions by estimating the following conditional fixed effects logit model:

$$(3)\ RP_{ijt} = \sum_{l=1}^{L} \beta_l RP_{it-l} + \tau_j Agromet_{j,t-1} + \sum_{n=1}^{4} \delta_n quarter_n + \sum_{k=2000}^{2002} \gamma_k year_k + \sum_{i=1}^{N} \gamma_i + \varepsilon$$

where RP_{ijt} is the risk perception of household i in community j at time t for a particular risk, in this case Insecurity. We allow lagged effects of up to L periods. Since theory does not suggest

the correct number of lagged perceptions (L) to include, we use goodness of fit (GOF) criteria (AIC, BIC and Hosmer-Lemeshow tests) to select among models with up to four lagged perceptions. In each case, the GOF measures suggest the use of four lags. While we only present the results with four lagged periods, the omitted models with shorter lags are qualitatively similar. $Agromet_{j,t-1}$ is a vector composed of linear and quadratic rainfall and NDVI measures for the quarter in which the income is earned. We also include quarter, year and household (γ_i) fixed effects. The error term, ε, is assumed to be iid normal.

The vector β_l contains the primary coefficients of interest, reflecting the effect of l^{th} lags of risk perceptions on current perceptions. If the βs are jointly insignificant, then current risk perceptions are independent of prior perceptions. τ_j represents the estimated marginal effect of prior agro-meteorological realizations on current risk perceptions. δ represents the estimated impact of seasonality, net of rainfall and NDVI from the prior quarter, on current perceptions.

The first column of Table 7 presents the results without the inclusion of shocks. The lagged values of perceptions of insecurity in the column are all individually significant and have a negative (but greater than -0.1) marginal effect, which implies that the effects of prior perceptions dissipate rapidly and oscillate over time. Although these marginal effects are highly significant statistically, their magnitudes and thus true economic significance are quite small. In this context, insecurity risk perceptions are largely newly determined each quarter, controlling for seasonality and agro-meteorological conditions. This rapid updating of subjective beliefs about the risk of violence is a hopeful indication that improvements in security can yield quick economic dividends.

Agro-meteorological conditions appear to play an important role in determining conflict risk perceptions, as above average levels of pasture (as reflected in NDVI) are significantly associated with insecurity. In particular, evaluated at the sample mean, a one standard deviation is very significantly associated with a 25 percent higher likelihood of being insecure. Insofar as NDVI is correlated across quarter, this large increase is partially offset by the negative coefficient on lagged NDVI. The finding that insecurity increases with pasture availability is consistent with several different explanations. For instance, better forage for animals might provide greater rewards for looting. Similarly, the better forage might facilitate raids by improving livestock health thereby making it easier to escape with them. In contrast to pasture quality, rainfall does not appear to influence perceptions of insecurity. This result is perhaps a little surprising as decreases in rainfall may lead to greater amounts of livestock and of different clans congregating competing for the same water holes.

While current perceptions respond to prior beliefs, this may mask the effects of the realization of these risks (i.e., violence). Moreover, in addition to information imparted by a shock, individuals frequently overweight information from recent shocks (Doss *et al.* 2008). Although the survey does not measure insecurity or violence directly, it does contain information at both the household and community levels for stolen livestock and raids respectively.

Since a number of community observations are missing and since some of these absences may by endogenous to perceptions, we first introduce the household measure for the number of stolen livestock over the previous quarter (column 2). As can be seen, this has no substantive impact on either the statistical significance or the magnitude of the estimated marginal effects of any of the lagged risk perception variables. This may partially reflect the relative few instances of cattle

theft in the data; thefts were reported in less than one half of one percent of the quarter-household observations.

Community shocks are included in the third column. The estimation contains only one lag of perceptions as the estimation fails to converge with additional lags. Despite this change in the structure of the model, the results are similar although the marginal effects greatly increase. The increase in the marginal effect of the lagged perception likely reflects both the effect of the one quarter lag and that of previous lags. Insofar as community level shocks are not statistically significant, the potential endogeneity of community attrition and the goodness of fit criteria, we place more weight on columns 1 and 2. Moreover, irrespective of the mode, the same results emerge: while prior beliefs matters, the effects of pasture quality are much important, and rainfall has no impact.

V. Discussion

Despite the central role played by risk in spreading the negative effects of conflict and violence, subjective perceptions of risk have not previously been directly measured in the economics literature. Using a unique panel of ten quarters of subjective risk data and incomes from southern Ethiopia, this paper makes several contributions to the literature. First, we examine the effect of subjective perceptions of insecurity risk on income and find that its effect is masked when it is constrained to be identical across quarters and income components. This suggests that cross-sectional analyses of the effects of insecurity may miss important effects since they typically only observe one period. Moreover, depending on the season, they may erroneously find that perceptions of insecurity are or are not associated with income.

Further research is needed to determine whether these seasonal effects of insecurity risk perceptions reflect livelihood decisions, such as herd migration, which are costly to reverse, or whether households simply smooth income across periods. Further, whereas the effect of the risk of conflict has previously been examined only in isolation from other risks, we explicitly control for the perceptions of a variety of other common risks. In general, the addition of other subjective perceptions did not greatly influence the results. This suggests that analyses of insecurity performed without accounting for other risks may suffer from little or no bias to these omitted variables.

Second, we examine how subjective risk perceptions of insecurity evolve across time and, particularly, the role of prior beliefs in determining current perceptions. While prior risk perceptions have a statistically significant effect on current beliefs, the magnitude of autocorrelation is relatively small and declines over time. This suggests that household largely determine their beliefs about the risk of violence anew each period within this setting. Consequently, insofar as subjective expectations determine outcomes, households and communities may recover relatively rapidly after episodes of violence.

Moreover, the literature on conflict has frequently focused on the role of rainfall in economy growth and the incidence of conflict (Miguel *et al.* 2004). Recent studies have tried to expand this focus to other factors such as temperature (Burke *et al.* 2009). We add to the literature by examining the relative effects of pasture (NDVI) as well as rainfall. While NDVI has been studied previously, for instance as an alternative to rainfall in earlier drafts[44] of Miguel *et. al.* (2004) which established the importance of rainfall, we are not aware of studies which study the

[44] In the BREAD working paper (#040) version of their paper, footnote 19 notes that previous versions of the paper used NDVI as an alternate measure of weather variation.

comparative effects, especially in the context of subjective risk perceptions. We find that measures of pasture availability (NDVI) are relatively more important than rainfall in determining current perceptions of insecurity risk. Insofar as risk perceptions are related to realizations or shocks, this suggests that rainfall might not be as important as the availability of pasture in primarily pastoralist settings, such as much of the Horn of Africa. These results suggest that agro-meteorological forecasts can perhaps be used to pre-emptively prepare policy interventions to combat the effects of insecurity. While data are often sparse in these regions, the importance of the NDVI suggests that remote sensing data can play an important role.

Unlike civil wars, which are anomalous events, reports of violence and insecurity have been commonplace in the pastoral communities which dominate arid and semi-arid lands (McPeak *et al.* 2012). This suggests a need to broaden the focus of the conflict literature from relatively rare civil wars to areas where insecurity has been and continues to be a regular feature of everyday life. More broadly, the nuanced effect of insecurity suggests a need for continued study to better understand its impacts and to guide policy.

Table 1: Average Quarterly Household Income and Sources

Total Income (Birr)	664	% of total
Trade and Business	37	5.6%
Livestock Sales	157	23.7%
Livestock Products	372	56.0%
Crop Harvested	26	3.9%
Remittances	65	9.8%
Wage and Salary	7	1.0%
Average household size	8.45	
Income per capita ($)*	0.10	
Observations	1296	

* Average exchange rate of 8.4 Birr/US Dollar during survey period

Table 2: Percent of Households Afraid of Risks in Coming Quarter

Risk	Ethiopia
Not enough food for people	88.4%
High prices for things you buy	82.8%
Low prices for animals you wish to sell	71.0%
Not enough pasture for animals	70.4%
Human sickness	69.0%
Insecurity/violence/fights	64.3%
Animal sickness/death	62.6%
Not enough water for animals	61.3%
No buyers for animals you wish to sell	59.2%
Crops Fail	59.0%
Animal loss due to theft/raiding	47.2%
Other	6.8%

Pooled Sample=1440

Table 3: Fear of Insecurity and Theft Disaggregated by Location

Community	Insecurity	Theft
Dida Hara	47.6%	24.5%
Dillo	88.0%	62.7%
Finchawa	5.5%	7.9%
Qorate	98.3%	97.3%
Wachille	82.7%	45.0%

Pooled Sample=1440

Table 4: Variation in Agro-Meteorological Conditions from Quarter Means (in Std Dev.)

Period	NDVI	Rainfall
2000: Q1	-0.15	-0.88
2000: Q2*	-0.23	-0.47
2000: Q3	0.27	2.44
2000: Q4**	0.27	0.11
2001: Q1	0.42	0.33
2001: Q2*	-0.14	-0.32
2001: Q3	-0.43	-0.68
2001: Q4**	-0.35	-0.42
2002: Q1	0.26	0.38
2002: Q2*	0.01	-0.03

* Indicates long rains

** indicates short rains

Table 5: Estimated Effects of Insecurity and Theft Risk Perceptions on Income and its Components (Birr)

Just Including Insecurity and Theft (K=2)

			Components of Income					
		Income	Trade	Livestock Sales	Livestock Products	Crop	Remittances	Wages
Insecurity,	t	-60.28	-76.47	33.01	-40.64	-6.51	28.81	1.53
		(145.13)	(71.66)	(39.79)	(86.25)	(17.58)	(28.86)	(5.62)
	t-1	-73.01	-93.38	13.38	63.07	-29.58	-30.03	3.53
		(120.75)	(87.83)	(38.71)	(52.01)	(20.85)	(24.80)	(6.86)
Theft,	t	20.85	-18.51	-20.11	90.87**	-4.09	-22.79	-4.52
		(70.68)	(23.15)	(30.02)	(43.61)	(15.75)	(16.17)	(3.96)
	t-1	-2.56	-54.12	-4.10	47.83	0.55	9.80	-2.51
		(65.67)	(43.11)	(26.07)	(33.39)	(7.27)	(19.61)	(5.24)
Total Obs		1152	1152	1152	1152	1152	1152	1152
Total HHs		144	144	144	144	144	144	144
Adjusted R^2		0.11	0.04	0.04	0.13	0.08	0.10	-0.01

Controlling for all Perceived Risks (K=12)

			Components of Income					
		Income	Trade	Livestock Sales	Livestock Products	Crop	Remittances	Wages
Insecurity,	t	-23.34	-33.94	27.51	-55.43	11.23	26.43	0.87
		(121.14)	(40.09)	(40.25)	(95.26)	(18.71)	(27.57)	(6.07)
	t-1	-47.79	-80.68	1.74	58.89	-16.09	-17.26	5.61
		(106.36)	(72.14)	(39.77)	(60.35)	(16.11)	(22.14)	(6.69)
Theft,	t	24.93	13.42	-48.58	87.14*	-10.74	-6.90	-9.42**
		(70.57)	(19.91)	(33.36)	(44.79)	(18.32)	(19.91)	(4.70)
	t-1	-27.58	-36.62	-17.15	7.66	-8.22	28.28	-1.53
		(68.32)	(24.54)	(33.43)	(42.19)	(10.65)	(19.43)	(5.63)
Total Obs		1152	1152	1152	1152	1152	1152	1152
Total HHs		144	144	144	144	144	144	144
Adjusted R^2		0.11	0.05	0.05	0.13	0.15	0.11	0.00

*,**,*** significant at the 10%, 5%, and 1% levels, respectively

The regressions also control for agro-meteorological conditions, household characteristics, livestock holdings, and household and time fixed effects.

Standard errors are in parentheses and are clustered at the household level

Table 6: Estimated Quarter-Specific Marginal Effects of Insecurity (Birr)

Insecurity, t	Marginal Effect of Insecurity in Quarter				Obs	Adj. R^2
	1	2	3	4		
Total Income (Birr)	52.76	-33.90	-431.32	-42.33	1152	0.17
	(145.58)	(144.43)	(265.61)	(195.52)		
Trade and Business	-42.45	-4.94	-148.34	12.80	1152	0.14
	(42.58)	(25.26)	(156.77)	(87.02)		
Livestock Sales	86.94	74.18	-143.95*	-42.98	1152	0.11
	(73.45)	(56.42)	(85.34)	(94.99)		
Livestock Products	9.41	-159.71	-135.20	-118.78	1152	0.18
	(119.43)	(132.44)	(122.91)	(93.92)		
Crop Harvested	-4.99	-5.92	-1.52	31.98	1152	0.25
	(10.41)	(30.32)	(70.26)	(17.43)		
Remittances	7.03	55.96	-0.35	67.79*	1152	0.13
	(27.70)	(44.96)	(130.64)	(39.81)		
Wage and Salary	-3.19	6.54	-1.97	6.85	1152	0.04
	(13.69)	(9.15)	(9.37)	(6.78)		
Insecurity, t-1	Marginal Effect of Insecurity in Quarter				Obs	adj R2
	1	2	3	4		
Total Income (Birr)	-89.75	4.92	160.18	341.43**	1152	0.17
	(125.60)	(160.18)	(309.92)	(141.93)		
Trade and Business	-24.89	-81.94	-212.65	-48.19	1152	0.14
	(58.38)	(77.99)	(167.63)	(46.82)		
Livestock Sales	21.24	20.33	-55.52	67.81	1152	0.11
	(69.25)	(59.75)	(116.75)	(79.87)		
Livestock Products	-4.89	98.88	201.34	235.27	1152	0.18
	(93.87)	(63.32)	(130.42)	(161.20)		
Crop Harvested	-20.67	-24.33	-3.47	25.00	1152	0.25
	(29.81)	(43.37)	(11.79)	(18.32)		
Remittances	-69.19*	-13.36	-23.28	39.40	1152	0.13
	(38.71)	(48.04)	(39.40)	(38.10)		
Wage and Salary	8.65	5.35	8.36	5.65	1152	0.04
	(12.88)	(6.65)	(9.13)	(9.76)		

*,**,*** significant at the 10%, 5%, and 1% levels, respectively

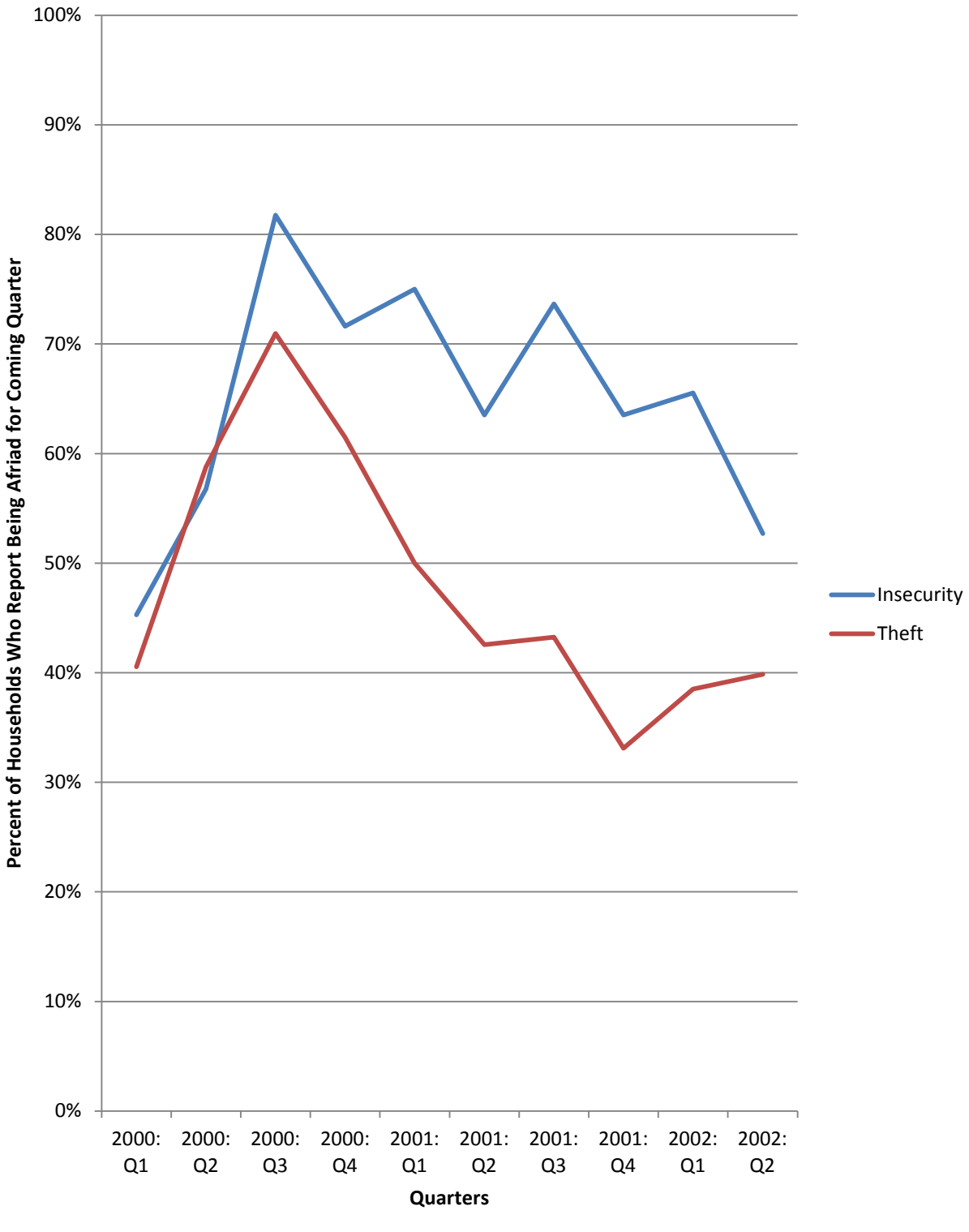
The regressions also control for agro-meteorological conditions, household characteristics, livestock holdings, and household and time fixed effects.

Standard errors are in parentheses and are clustered at the household level

Table 7: Marginal Effect of Conditional Fixed Effect Logistic on Perceptions

		(1)	(2)	(3)
Perception,	t-1	-0.06***	-0.05***	-0.20***
		(0.01)	(0.01)	(0.07)
	t-2	-0.06***	-0.05***	-
		(0.01)	(0.01)	
	t-3	-0.04***	-0.04***	-
		(0.01)	(0.01)	
	t-4	-0.07***	-0.06***	-
		(0.02)	(0.01)	
NDVI (at mean), t		0.25***	0.24***	0.63***
		(0.07)	(0.06)	(0.23)
NDVI (at mean), t-1		-0.11*	-0.11*	0.17
		(0.06)	(0.06)	(0.20)
Rainfall (at mean), t		-0.00	0.00	-0.00
		(0.04)	(0.04)	(0.18)
Rainfall (at mean), t-1		-0.05	-0.05	-0.02
		(0.03)	(0.03)	(0.11)
Quarter 1 (1=yes)		0.06***	0.05***	0.49***
		(0.02)	(0.02)	(0.08)
Quarter 2 (1=yes)		0.10**	0.09**	0.61**
		(0.04)	(0.04)	(0.24)
Quarter 3 (1=yes)		0.28**	0.27**	0.91***
		(0.12)	(0.12)	(0.09)
Quarter 4 (1=yes)		0.02	0.02	0.75***
		(0.03)	(0.03)	(0.19)
Livestock stolen		-	-0.06	0.01
			(0.05)	(0.21)
Raid in community		-	-	-0.16
				(0.14)
Total Obs		444	444	535
Total HHs		74	74	78
AIC		216.23	216.94	307.92
BIC		281.76	286.57	376.43

Figure 1: Perceptions of Insecurity and Theft Across Time



Appendix Table 1: Variables and Data

	Mean	Std. Dev	Min	Max
Total Income (Birr)	662.9	996.9	-1619.7	13437.5
Trade and Business	37.0	390.9	0.0	9000.0
Livestock Sales	6.4	46.4	0.0	1000.0
Livestock Products	158.9	356.6	0.0	3200.0
Crop Harvested	370.5	705.6	0.0	9200.0
Remittances	25.0	135.3	0.0	2718.1
Wage and Salary	65.1	193.3	-3000.0	2393.4
Household size	8.7	4.5	2.0	22.0
Any livestock stolen	0.0	0.1	0.0	1.0
NDVI	0.0	0.4	-0.6	1.4
$(NDVI)^2$	0.2	0.3	0.0	1.9
Rainfall	0.2	0.9	-1.0	3.4
$(Rainfall)^2$	0.9	2.4	0.0	11.7
Any raid in community	0.3	0.4	0.0	1.0
Not enough pasture for animals	0.7	0.5	0.0	1.0
Not enough water for animals	0.6	0.5	0.0	1.0
Animal sickness/death	0.6	0.5	0.0	1.0
Animal loss due to theft/raiding	0.5	0.5	0.0	1.0
Insecurity/violence/fights	0.7	0.5	0.0	1.0
Human sickness	0.7	0.5	0.0	1.0
No buyers for animals you wish to sell	0.6	0.5	0.0	1.0
Low prices for animals you wish to sell	0.7	0.5	0.0	1.0
Not enough food for people	0.9	0.3	0.0	1.0
High prices for things you buy	0.8	0.4	0.0	1.0
Crops Fail	0.6	0.5	0.0	1.0
Other	0.1	0.2	0.0	1.0
Death in the HH	0.0	0.1	0.0	1.0
Adult death in HH	0.0	0.1	0.0	1.0
Age Head of HH	49.8	16.4	23.0	100.0
$(Age\ of\ Head)^2$	2748.0	1867.0	529.0	10000.0
Herd size (TLU)	13.8	26.4	0.0	438.1
$(Herd\ size)^2$	886.0	7123.6	0.0	191960.1

Appendix 1 Table 2: Impact of Perceptions on Income, Full Results (K=2)

		Components of Income					
	Income	Trade	Livestock Sales	Livestock Products	Crop	Remittances	Wages
Insecurity, t	-60.28	-76.47	33.01	-40.64	-6.51	28.81	1.53
	[145.13]	[71.66]	[39.79]	[86.25]	[17.58]	[28.86]	[5.62]
Insecurity, t-1	-73.01	-93.38	13.38	63.07	-29.58	-30.03	3.53
	[120.75]	[87.83]	[38.71]	[52.01]	[20.85]	[24.80]	[6.86]
Theft, t	20.85	-18.51	-20.11	90.87**	-4.09	-22.79	-4.52
	[70.68]	[23.15]	[30.02]	[43.61]	[15.75]	[16.17]	[3.96]
Theft, t-1	-2.56	-54.12	-4.1	47.83	0.55	9.8	-2.51
	[65.67]	[43.11]	[26.07]	[33.39]	[7.27]	[19.61]	[5.24]
Rainfall	66.72	-70.27	127.53***	87.4	-7.56	-74.64***	4.26
	[104.01]	[56.78]	[43.99]	[56.08]	[22.37]	[25.70]	[5.49]
$(\text{Rainfall})^2$	33.13	23.93	-27.07*	9.63	-3.64	31.79***	-1.52
	[40.83]	[18.73]	[15.93]	[25.12]	[5.94]	[10.83]	[2.31]
NDVI	-1,160.57***	-16.83	-251.73***	-931.34***	-56.27*	92.20***	3.39
	[189.79]	[30.30]	[76.51]	[160.56]	[29.03]	[33.59]	[8.20]
$(\text{NDVI})^2$	600.84***	-0.91	86.09	498.48***	77.85***	-56.91**	-3.75
	[140.55]	[17.17]	[61.06]	[118.02]	[21.87]	[28.79]	[7.42]
Quarter 1 (1=yes)	108.65*	21.42	-6.64	125.21**	-33.64***	-0.85	3.14
	[59.90]	[39.66]	[38.03]	[49.96]	[11.43]	[22.49]	[4.34]
Quarter 3 (1=yes)	-397.23***	-4.2	-58.92	-395.89***	23.63	32.44	5.72
	[111.51]	[50.71]	[49.98]	[89.24]	[16.80]	[29.13]	[10.45]
Quarter 4 (1=yes)	-79.9	20.75	41.62	-107.64	-45.37***	9.11	1.63
	[96.97]	[49.91]	[52.49]	[83.83]	[14.71]	[23.44]	[5.81]
Year=2001 (1=yes)	-291.99***	-27.08	37.96	-246.18***	-20.81*	-43.31***	7.44
	[71.47]	[26.95]	[35.60]	[50.81]	[11.05]	[11.85]	[4.58]
Herd size (TLU), t-1	17.67***	1.74	4.85**	10.12***	1.52**	-0.72	0.16*
	[5.46]	[1.83]	[1.90]	[3.82]	[0.75]	[1.06]	[0.09]
$(\text{Herd size})^2$, t-1	-0.06	-34.71	6.51	59.74	0.12	0.02	-0.02
	[125.46]	[0.00]	[0.47]	[85.41]	[24.09]	[0.23]	[0.00]
Age Head of HH, t-1	-0.06***	-0.02***	-0.09	-0.11	-0.00***	0.01***	2.9
	[0.01]	[51.02]	[0.00]	[0.01]	[0.18]	[22.88]	[7.03]
$(\text{Age of Head})^2$, t-1	-0.31	0.01	-0.01***	-0.04***	-0.74	-34	-0.00*
	[1.14]	[0.30]	[47.90]	[0.73]	[0.00]	[0.00]	[0.04]
Livestock stolen, t	-253.31	17.93	-137.49*	-251.85**	51.29	66.65	0.15
	[229.62]	[44.76]	[78.26]	[112.44]	[32.58]	[74.86]	[6.89]
Death in the HH, t	367.54	-16.42	206.18	178.27	-24.23	36.37	-12.62
	[298.81]	[21.25]	[133.38]	[177.12]	[17.51]	[47.63]	[10.00]
Adult death in HH, t	-293.97	51.75	-325.75**	-24.97	49.5	-48.54	4.04
	[366.91]	[47.35]	[149.07]	[237.95]	[60.22]	[48.26]	[11.09]
Observations	1152	1152	1152	1152	1152	1152	1152
Number of master	144	144	144	144	144	144	144
Adj. R^2	0.11	0.04	0.04	0.13	0.08	0.1	-0.01

*,**,*** significant at the 10%, 5%, and 1% levels, respectively

Standard errors in brackets, errors are clustered at the household level

Appendix 1 Table 2: Impact of Perceptions on Income, Full Results (Continued with K=12)

		Components of Income					
	Income	Trade	Livestock Sales	Livestock Products	Crop	Remittances	Wages
Insecurity, t	-23.34	-33.94	27.51	-55.43	11.23	26.43	0.87
	[121.14]	[40.09]	[40.25]	[95.26]	[18.71]	[27.57]	[6.07]
Insecurity, t-1	-47.79	-80.68	1.74	58.89	-16.09	-17.26	5.61
	[106.36]	[72.14]	[39.77]	[60.35]	[16.11]	[22.14]	[6.69]
Theft, t	24.93	13.42	-48.58	87.14*	-10.74	-6.9	-9.42**
	[70.57]	[19.91]	[33.36]	[44.79]	[18.32]	[19.91]	[4.70]
Theft, t-1	-27.58	-36.62	-17.15	7.66	-8.22	28.28	-1.53
	[68.32]	[24.54]	[33.43]	[42.19]	[10.65]	[19.43]	[5.63]
Rainfall	118.44	-70.86	113.19**	114.44*	7.84	-48.28*	2.11
	[108.66]	[56.68]	[43.52]	[61.95]	[14.33]	[27.91]	[5.79]
$(\text{Rainfall})^2$	10.82	22.05	-23.07	0.88	-10.34***	22.47*	-1.17
	[42.68]	[17.11]	[16.12]	[28.19]	[3.71]	[12.48]	[2.42]
NDVI	-1,179.95***	-12.88	-249.08***	-936.44***	-40.03	53.62	4.86
	[207.21]	[37.09]	[82.70]	[165.99]	[25.25]	[37.04]	[11.00]
$(\text{NDVI})^2$	568.19***	-36.53	89.28	517.81***	47.16**	-44.17	-5.36
	[150.24]	[45.90]	[63.01]	[127.65]	[20.62]	[32.74]	[9.74]
Quarter 1 (1=yes)	128.13*	19.81	-7.53	141.94***	-20.51*	-10.91	5.33
	[67.93]	[40.63]	[45.84]	[46.64]	[12.38]	[24.61]	[5.09]
Quarter 3 (1=yes)	-386.19***	-15.27	-87.9	-353.21***	38.25**	24.82	7.12
	[118.39]	[47.92]	[53.70]	[85.06]	[15.21]	[30.10]	[11.33]
Quarter 4 (1=yes)	-74.23	4.29	25.7	-72.68	-26.57**	-8.18	3.21
	[114.12]	[36.05]	[60.54]	[81.31]	[11.30]	[20.58]	[6.35]
Year=2001 (1=yes)	-294.58***	-35	32.83	-231.31***	-10.33	-57.53***	6.76
	[79.40]	[31.32]	[38.32]	[53.46]	[7.22]	[13.88]	[4.74]
Herd size (TLU), t-1	18.30***	1.68	5.14***	10.47***	1.51**	-0.57	0.08
	[5.57]	[1.84]	[1.95]	[3.90]	[0.62]	[1.24]	[0.07]
$(\text{Herd size})^2$, t-1	11.77	-56.49	-0.01***	-0.26	11.12	0.03	0
	[1.18]	[0.00]	[0.48]	[0.70]	[18.58]	[0.00]	[0.04]
Age Head of HH, t-1	-0.42	-0.02***	-4.4	-0.04***	-0.02	0.01***	-0.02
	[137.14]	[60.93]	[55.82]	[0.01]	[0.17]	[0.24]	[6.43]
$(\text{Age of Head})^2$, t-1	-0.06***	-0.13	-0.02	113.06	-0.00***	-52.97*	1.45
	[0.01]	[0.40]	[0.00]	[86.75]	[0.00]	[27.94]	[0.00]
Livestock stolen, t	-166.08	29.25	-84.97	-236.76*	61.31	63.95	1.13
	[271.65]	[78.58]	[108.20]	[126.44]	[41.82]	[78.96]	[6.28]
Death in the HH, t	375.71	-12.63	160	217.12	-15.23	34.75	-8.3
	[300.66]	[39.58]	[132.02]	[179.56]	[18.25]	[51.34]	[6.38]
Adult death in HH, t	-380.91	9.56	-317.27**	-19.37	5.18	-55.33	-3.67
	[375.31]	[42.32]	[143.77]	[243.31]	[55.49]	[52.39]	[11.32]
Animal pasture, t	61.11	13.24	10.6	40.27	6.92	-18.28	8.37
	[68.82]	[41.56]	[35.13]	[40.84]	[11.81]	[17.25]	[8.24]
Animal pasture, t-1	-0.24	-14.58	30.03	-4.69	-12.78	1.77	0.01
	[82.69]	[27.20]	[28.20]	[50.42]	[15.38]	[11.94]	[4.98]
Water for animals, t	19.29	39.58	50.56	-92.83**	4.84	22.22	-5.08
	[65.19]	[37.61]	[34.91]	[44.03]	[12.16]	[19.24]	[6.11]
Water for animals, t-1	-95.01	11.11	-1.93	-63.94	-12	-31.75*	3.5
	[78.89]	[15.84]	[34.02]	[51.55]	[17.01]	[17.88]	[5.50]

Animal sickness, t	25.11	-48.45	-7.65	87.9	21.83	-30.13	1.61
	[51.61]	[42.57]	[38.55]	[71.00]	[16.97]	[26.66]	[5.56]
Animal sickness, t-1	200.58**	22.29	20.59	112.77*	33.29	17.35	-5.71
	[92.65]	[22.67]	[30.79]	[64.53]	[22.51]	[19.10]	[4.06]
Human sickness, t	-42.33	-22.03	1.19	-24.04	15.55	-14.68	1.67
	[60.11]	[14.21]	[31.93]	[46.89]	[15.69]	[19.06]	[4.21]
Human sickness, t-1	-34.98	19.12	1.15	-13.74	-15.39	-25.8	-0.32
	[81.77]	[23.36]	[39.88]	[45.13]	[19.15]	[19.88]	[5.48]
No buyer animals, t	-45.3	-26.86	25.84	-23.82	-14.92	-15.35	9.82*
	[60.06]	[34.33]	[39.62]	[48.94]	[14.60]	[21.97]	[5.23]
No buyer animals, t-1	54.06	-25.77	21.27	45.71	22.13	-12.85	3.57
	[65.52]	[23.02]	[32.91]	[48.75]	[16.64]	[17.62]	[6.58]
Low animal price, t	11.09	14.79	-34.44	-0.63	-1.58	37.85	-4.9
	[61.83]	[18.68]	[45.40]	[62.74]	[14.84]	[24.89]	[5.52]
Low animal price, t-1	-100.72	-1.69	-61.29*	-30.52	-4.18	-0.31	-2.72
	[61.90]	[15.44]	[33.47]	[35.35]	[19.51]	[14.83]	[2.92]
Food for people, t	-174.75	-105.56	-8.53	56.26	-93.99***	-10.51	-12.42
	[140.41]	[80.42]	[43.19]	[86.64]	[30.90]	[20.75]	[9.64]
Food for people, t-1	-73.39	-61.63	-36.08	132.68	-65.49**	-30.3	-12.58
	[168.82]	[94.40]	[63.45]	[98.22]	[28.35]	[25.25]	[7.90]
High prices, t	20.63	-16.46	17.31	-31.42	36.71	8.15	6.32
	[84.70]	[23.79]	[31.52]	[63.44]	[27.67]	[22.91]	[6.73]
High prices, t	-18.44	-40.38	42.18	-22.67	14.94	-7.25	-5.27
	[84.51]	[36.59]	[46.62]	[55.22]	[16.64]	[22.69]	[7.44]
Crops fail, t	129.47**	23.22	79.85**	1.01	-19.87	44.39**	0.88
	[54.68]	[20.17]	[37.12]	[40.25]	[15.01]	[19.90]	[3.25]
Crops fail, t-1	-102.35	-4.36	96.94**	-124.68***	-36.97*	-36.35*	3.06
	[71.16]	[10.82]	[38.06]	[42.49]	[19.49]	[18.42]	[3.59]
Other shock, t	165.04	99.1	72.85	-38.3	27	5.37	-0.97
	[111.18]	[96.98]	[45.31]	[56.41]	[31.51]	[43.37]	[4.75]
Other shock, t-1	178.64*	51.14	56.58	-24.92	68.16**	31.32	-3.64
	[105.05]	[41.91]	[45.33]	[60.11]	[33.19]	[37.64]	[3.77]
HH size, t-1	13.3	11.44	-33.72	48.36	-7.72	-4.88	-0.18
	[105.58]	[70.31]	[31.82]	[53.82]	[9.30]	[9.46]	[2.61]
Observations	1152	1152	1152	1152	1152	1152	1152
Number of master	144	144	144	144	144	144	144
Adj. R^2	0.11	0.05	0.05	0.13	0.15	0.11	0.00

*,**,*** significant at the 10%, 5%, and 1% levels, respectively

Standard errors in brackets, errors are clustered at the household level

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CHAPTER 5

THE RISK OF VIOLENCE: POLICY AND RESEARCH IMPLICATIONS

The 2011 World Development Report (WDR) reports that roughly one quarter of individuals live either in fragile and conflict-affected countries or in countries with very high levels of violence (World Bank 2011). Moreover, recent elections in Sub-Saharan Africa have been associated with violence (Kenya 2007; Zimbabwe 2008) and coups (Mali and Guinea-Bissau 2012) with some research that violence affects between 19 and 25 percent of elections in Africa (Bekoe 2010).

Consequently, beyond the current focus of finding policies to help countries transition from post-conflict to developing, it is urgent to understand which policies are effective during conflicts and widespread insecurity The importance is further underlined by new research pointing to the lasting effects of conflict not only on poverty but also on long run health and education levels – two vital and often irreversible determinants of the intergenerational transfer of poverty. Since recent research suggests that much of these costs are due to self-imposed costly responses to insecurity, this also suggests strong benefits to active policy interventions.

Although this new research has noted the importance of insecurity and household responses, the risk of violence has not yet been quantitatively measured. The primarily contribution of this dissertation has been to formally measure and quantify its effects. The primary result which emerges from chapters 2, 3 and 4 are the important costs of insecurity. These high costs emerge equally in Uganda, which was in the midst of large and long-lasting civil war, as well as in Ethiopia, an area without large organized violence but rather a history of more sporadic and isolated violence as well as established conflict-risk mitigation strategies. While the estimated

household losses from insecurity during the civil war (chapter 2) appear modest, roughly 2 to 6 percent, these are arguably quite large since they compound over time and since the average civil war last roughly 7 years (Collier and Hoeffler 2007).

While the dissertation adds to our understanding of the effects of insecurity, further research is needed to begin to formulate research-driven policy. In particular, fours areas stand out. First, while the dissertation has quantified the importance of insecurity, it focuses on income, consumption and asset portfolios. However, as noted earlier, many of the important consequences from conflict are through non-monetary factors such as education and nutrition. Are the costs identified by the literature primarily due to insecurity or actual exposure to violence? If the former, are these costs the result of the decreased income identified in the dissertation, general equilibrium effects through prices, switches in livelihoods or even changes in intra-household allocations? In particular, for nutrition, each of these may suggest different policy interventions. For instance, Valente (2011) finds that *in utero* exposure to conflict leads to worse health and birth outcomes. Since she does not differentiate between risk and exposure and then among the different pathways ranging from stress to malnutrition to shifts in income, it is not possible to design an effective policy response.

Second, since conflicts persist across time, it is important better understand the importance of the timing of perceptions of insecurity. Chapter 5 finds that strong seasonality in the effects of subjective expectations of insecurity. While this is strongly influenced by the pastoral setting and the bimodal distribution of rainfall, it is likely present in other settings in which income streams are lumpy or where household make costly and potentially irreversible decisions on income streams at particular points in the year such as in agriculture. Further research is needed to understand the implications of seasonality on the effects of insecurity. In particular, multiple

period models which incorporate sequential investments and the timing of decisions and of subjective expectations of insecurity can usefully identify the importance of the timing of perceptions.

Third, there is a need to models that can forecast instability and violence. As chapter 5 discusses, agro-meteorological conditions may be particularly important as rainfall and, especially, pasture quality are linked with perceptions of insecurity. While certainly not true in all contexts, remote sensing data may be useful in many pastoral contexts although further research is needed. While the researchers with links to the military have already begun to incorporate agro-ecological conditions into models of conflict (The Economist 2012), their focus is on the outbreak of violence. As discussed in the dissertation, the majority of monetary losses from conflict arise from costly household responses to insecurity. Since insecurity can arise without the outbreak of violence, research on forecasting subjective expectations of insecurity (as opposed to the outbreak of violence) can play an important role in targeting policies and humanitarian aid.

Fourth, the dissertation has pointed to the important behavioral responses to insecurity. Insofar as conflicts often persist across long periods of time and, since the only experience with economic activity of some young adults is during conflict, do some of these behavioral consequences become ingrained? For instance, do individuals post-conflict have different propensities to save or to invest across risky assets based on their experience with insecurity (i.e., duration and initial age at exposure)? Similarly, recent research has identified important behavioral consequences from exposure to violence. If the insecurity does lead to behavioral changes, what is the relationship between the two? The effect of exposure to violence may depend on the prior exposure to insecurity. Similarly, while there appear to be widespread behavioral responses to insecurity, these could be amplified by previous exposure to violence. This would fit both within

the mental health literature, such as with post-traumatic stress disorder, or the economics literature which finds that proximity to events may distort perceptions.

Additionally, the behavioral consequences of exposure to violence are typically identified by comparing individuals within the conflict, specifically those with histories of exposure to violence with those with no prior exposure. This identification strategy may provide only a lower bound estimate since the non-treated population has been affected by insecurity. This suggests that comparisons of the behavioral effects of different degrees of exposure might offer more precise measures.

The WDR 2011 notes that no Millennium Development Goal has been achieved by a low income fragile or conflict-affected country (World Bank 2011). Hopefully, this dissertation makes a small contribution to designing policies to address this.

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